

**ANTIBODIES THAT BIND CELL-ASSOCIATED CA 125/O772P  
AND METHODS OF USE THEREOF**

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[0001] The present application claims priority under 35 U.S.C. §119(e) to U.S. provisional patent applications 60/418,828, filed October 16, 2002 and 60/485,986, filed July 10, 2003, each of which is incorporated herein by reference in its entirety.

**1. FIELD OF THE INVENTION**

[0002] The present invention provides antibodies, and antigen-binding fragments of antibodies, that preferentially bind cell-associated CA 125/O772P polypeptides relative to shed CA 125/O772P polypeptides, methods for identifying such antibodies and antigen-binding fragments, and methods for making such antibodies and antigen-binding antibody fragments. The present invention further provides methods of preventing, managing, treating or ameliorating one or more symptoms associated with a CA 125/O772P-related disorder. In particular, the present invention provides methods of preventing, managing, treating, or ameliorating one or more symptoms associated with a cell proliferative disorder. For example, the present invention provides methods of preventing, managing, treating or ameliorating one or more symptoms associated with cancer. In a preferred embodiment, the present invention provides methods of preventing, managing, treating or ameliorating one or more symptoms of ovarian cancer. The present invention also provides compositions and articles of manufacture for use in preventing, managing, treating or ameliorating one or more symptoms associated with a CA 125/O772P-related disorder, for example cancer, *e.g.*, ovarian cancer. The present invention still further provides methods for diagnosing a CA 125/O772P-related disorder or predisposition to developing such a disorder.

**2. BACKGROUND OF THE INVENTION**

[0003] The high molecular weight polypeptide referred to as CA 125 can be detected in approximately 80% of all patients with ovarian carcinomas (see Kabawat *et al.*, Am. J. Clin. Pathol. 79:98-104 (1983); and Gadducci *et al.*, Gynecol. Oncol. 44:147-154 (1992)). CA 125 is present on the surface of tumor cells, and elevated secreted, or “shed,” forms of CA 125 are present in approximately 80-90% of ovarian cancer patients.

[0004] Antibodies directed against CA 125 have been produced and utilized for the determination of CA 125 concentrations and for purification of CA 125 from cell culture

medium. See, *e.g.*, Bast *et al.*, J. Clin. Invest. 68(5):1331-1337 (1981); Krantz *et al.*, J. Cell. Biochem. (Suppl.) 12(E):139 (1988); U.S. Patent Nos. 4,921,790, 5,059,680, and 5,976,818; and JP11014626.

[0005] In addition to antibodies for monitoring the presence of CA 125, U.S. Patent Nos. 5,858,361 and 6,241,985 describe anti-idiotypic anti-CA 125 antibodies as therapeutic agents.

[0006] Despite the above, CA 125-related disorders such as ovarian cancer remain a major problem and, as such, a great need exists for methods and compositions for the treatment of such disorders.

[0007] Citation or identification of any reference in this or any other section of this application shall not be construed as an admission that such reference is available as prior art to the present invention.

### 3. SUMMARY OF THE INVENTION

[0008] The present invention is based, in part, on the recognition that the events that produce shed CA 125/O772P also leave a portion of the extracellular region of the CA 125/O772P amino acid sequence in cell-associated form, *i.e.*, also yield cell-associated CA 125/O772P. The present invention is further based, in part, on the recognition that antibodies, and antigen-binding antibody fragments, that preferentially bind cell-associated CA 125/O772P relative to shed CA 125/O772P can be generated, and that such antibodies, or antigen-binding antibody fragments, can, for example, be utilized to prevent, manage, treat or ameliorate a CA 125/O772P-related disorder or one or more symptoms of a CA 125/O772P-related disorder such as a cell proliferative disorder, for example, cancer, *e.g.*, ovarian cancer.

[0009] In a first aspect, the present invention provides an isolated antibody, or an antigen-binding antibody fragment, that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide. Also provided is an isolated antibody or antigen-binding antibody fragment that binds to the peptide of Figure 1. Such antibodies and antigen-binding antibody fragments of the invention are useful for a variety of therapeutic, prophylactic, diagnostic, and purification purposes as described herein.

[0010] In another embodiment, an antibody or antigen-binding antibody fragment of the invention is one that binds the peptide of SEQ ID NO:1 or SEQ ID NO:2 and preferentially binds cell-associated CA 125/O772P. In one particular such embodiment, the antibody or antigen-binding antibody fragment of the invention binds the non-repeat region depicted in SEQ ID NO:1 or SEQ ID NO:2. In another such embodiment, the antibody or

antigen-binding antibody fragment of the invention binds a repeat region depicted in SEQ ID NO:1 or SEQ ID NO:2.

[0011] In a first embodiment, the antibody or antigen-binding antibody fragment of the invention exhibits, in an ELISA Competition Assay, less than about 25%, less than about 20%, less than about 15%, less than about 10%, or less than about 5% inhibition of binding to the peptide of Figure 1 (SEQ ID NO: 1) in the presence of a 25-fold (weight/weight) excess of shed CA 125/O772P over the peptide of Figure 1 (SEQ ID NO: 1). In a second embodiment, the antibody or antigen-binding antibody fragment of the invention exhibits, in a Flow Cytometry Competition Assay, an  $IC_{50}$ , as measured by percent-positive cells, of at least about 0.05 mg/ml, at least about 0.25 mg/ml, at least about 0.5 mg/ml, at least about 0.75 mg/ml, or at least about 1.0 mg/ml shed CA 125/O772P. In a third embodiment, the antibody or antigen-binding antibody fragment of the invention binds the peptide of Figure 1, but does not detectably bind shed CA 125/O772P polypeptide.

[0012] An antibody, or antigen-binding antibody fragment, that satisfies any one of these three embodiments constitutes an antibody or antigen-binding antibody fragment that “preferentially binds” cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide.

[0013] Among the antibodies and antigen-binding antibody fragments of the invention are antibodies or antigen-binding antibody fragments that bind the peptide of Figure 1 (SEQ ID NO: 1) with a  $K_d$  of less than about 100nM, less than about 10nM, less than about 1nM, less than about 100pM, or less than about 10pM as measured by the BIAcore Affinity Assay, which is described in Section 6.4, hereinbelow.

[0014] Among the preferred embodiments of the antibodies or antigen-binding antibody fragments of the invention are antibodies or antigen-binding antibody fragments that mediate lysis of CA 125/O772P-positive tumor cells in an antibody-dependent cellular cytotoxicity (ADCC) assay. Such antibodies or antigen-binding antibody fragments include, for example, ones that mediate at least about 10% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 50:1 effector:target ratio at a concentration of 5  $\mu$ g antibody or antigen-binding fragment per ml; mediate at least about 20% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 50:1 effector:target ratio at a concentration of 5  $\mu$ g antibody or antigen-binding fragment per ml; mediate at least about 10% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 50:1 effector:target ratio at a concentration of 5.0  $\mu$ g antibody or antigen-binding fragment per ml; mediate at least about 10% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 25:1 effector:target

ratio at a concentration of 5  $\mu$ g antibody or antigen-binding antibody fragment per ml; mediate at least about 10% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 12.5:1 effector:target ratio at a concentration of 5  $\mu$ g antibody or antigen-binding antibody fragment per ml; mediate at least about 10% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 12.5:1 effector:target ratio at a concentration of 0.5  $\mu$ g antibody or antigen-binding antibody fragment per ml; or that mediate at least about 10% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 12.5:1 effector:target ratio at a concentration of 50 ng antibody or antigen-binding antibody fragment per ml.

[0015] Preferred embodiments of the invention also include antibodies or antigen-binding antibody fragments that mediate lysis of CA 125/O772P-positive tumor cells in a complement-dependent cytotoxicity (CDC) assay. Such antibodies or antigen-binding antibody fragments include, for example, ones that mediate lysis in a range of about 15% lysis at 5 $\mu$ g/ml to about 95% lysis at about 0.1 $\mu$ g/ml antibody or antigen-binding antibody fragment concentration.

[0016] Preferred embodiments of the antibodies or antigen-binding antibody fragments of the invention also include antibodies and antigen-binding antibody fragments that inhibit CA 125/O772P-positive tumor growth.

[0017] In one particular embodiment, an antibody of the invention is a monoclonal antibody produced by hybridoma 4E7 (ATCC<sup>®</sup> Accession No. PTA-5109), or by hybridoma 7A11 (ATCC<sup>®</sup> Accession No. PTA-5110), or by hybridoma 7C6 (ATCC<sup>®</sup> Accession No. PTA-5111), or by hybridoma 7F10 (ATCC<sup>®</sup> Accession No. PTA-5112), or by hybridoma 7G10 (ATCC<sup>®</sup> Accession No. PTA-5245), or by hybridoma 7H1 (ATCC<sup>®</sup> Accession No. PTA-5114), or by hybridoma 8A1 (ATCC<sup>®</sup> Accession No. PTA-5115), or by hybridoma 8B5 (ATCC<sup>®</sup> Accession No. PTA-5116), or by hybridoma 8C3 (ATCC<sup>®</sup> Accession No. PTA-5246), or by hybridoma 8E3 (ATCC<sup>®</sup> Accession No. PTA-5118), or by hybridoma 8G9 (ATCC<sup>®</sup> Accession No. PTA-5119), or by hybridoma 15C9 (ATCC<sup>®</sup> Accession No. PTA-5106), or by hybridoma 16C7 (ATCC<sup>®</sup> Accession No. PTA-5107), or by hybridoma 16H9 (ATCC<sup>®</sup> Accession No. PTA-5108), or by hybridoma 117.1 (ATCC<sup>®</sup> Accession No. PTA-4567), or by hybridoma 325.1 (ATCC<sup>®</sup> Accession No. PTA-5120), or by hybridoma 368.1 (ATCC<sup>®</sup> Accession No. PTA-4568), or by hybridoma 446.1 (ATCC<sup>®</sup> Accession No. PTA-5549), or by hybridoma 501.1 (ATCC<sup>®</sup> Accession No. PTA-4569), or by hybridoma 621.1 (ATCC<sup>®</sup> Accession No. PTA-5121), or by hybridoma 633.1 (ATCC<sup>®</sup> Accession No. PTA-5122), or by hybridoma 654.1 (ATCC<sup>®</sup> Accession No. PTA-5247), or by hybridoma 725.1



(ATCC<sup>®</sup> Accession No. PTA-5124), or by hybridoma 776.1 (ATCC<sup>®</sup> Accession No. PTA-4570).

[0018] In another particular embodiment, an antibody or antigen-binding antibody fragment of the invention is an antibody or antigen-binding antibody fragment that competes with the monoclonal antibody produced by hybridoma 4E7 (ATCC<sup>®</sup> Accession No. PTA-5109), or by hybridoma 7A11 (ATCC<sup>®</sup> Accession No. PTA-5110), or by hybridoma 7C6 (ATCC<sup>®</sup> Accession No. PTA-5111), or by hybridoma 7F10 (ATCC<sup>®</sup> Accession No. PTA-5112), or by hybridoma 7G10 (ATCC<sup>®</sup> Accession No. PTA-5245), or by hybridoma 7H1 (ATCC<sup>®</sup> Accession No. PTA-5114), or by hybridoma 8A1 (ATCC<sup>®</sup> Accession No. PTA-5115), or by hybridoma 8B5 (ATCC<sup>®</sup> Accession No. PTA-5116), or by hybridoma 8C3 (ATCC<sup>®</sup> Accession No. PTA-5246), or by hybridoma 8E3 (ATCC<sup>®</sup> Accession No. PTA-5118), or by hybridoma 8G9 (ATCC<sup>®</sup> Accession No. PTA-5119), or by hybridoma 15C9 (ATCC<sup>®</sup> Accession No. PTA-5106), or by hybridoma 16C7 (ATCC<sup>®</sup> Accession No. PTA-5107), or by hybridoma 16H9 (ATCC<sup>®</sup> Accession No. PTA-5108), or by hybridoma 117.1 (ATCC<sup>®</sup> Accession No. PTA-4567), or by hybridoma 325.1 (ATCC<sup>®</sup> Accession No. PTA-5120), or by hybridoma 368.1 (ATCC<sup>®</sup> Accession No. PTA-4568), or by hybridoma 446.1 (ATCC<sup>®</sup> Accession No. PTA-5549), or by hybridoma 501.1 (ATCC<sup>®</sup> Accession No. PTA-4569), or by hybridoma 621.1 (ATCC<sup>®</sup> Accession No. PTA-5121), or by hybridoma 633.1 (ATCC<sup>®</sup> Accession No. PTA-5122), or by hybridoma 654.1 (ATCC<sup>®</sup> Accession No. PTA-5247), or by hybridoma 725.1 (ATCC<sup>®</sup> Accession No. PTA-5124), or by hybridoma 776.1 (ATCC<sup>®</sup> Accession No. PTA-4570) for binding to cell-associated CA 125/O772P.

Antibodies or antigen-binding antibody fragments of the invention are considered to compete for binding if they compete for binding in an ELISA Cross-Competition Assay and/or a FACS Cross-Competition Assay. An antibody or antigen-binding antibody fragment is considered to compete for binding in an ELISA Cross-Competition Assay or a FACS Cross-Competition Assay if the IC<sub>50</sub> for the competitor antibody or antigen-binding fragment is a concentration no more than about 100-fold above the concentration of the antibody or antigen-binding antibody fragment. In a preferred embodiment, the IC<sub>50</sub> of the competitor antibody or antigen-binding antibody fragment is a concentration no more than about 10-fold above the concentration of the antibody or antigen-binding fragment. In a more preferred embodiment, the IC<sub>50</sub> of the competitor antibody or antigen-binding antibody fragment is a concentration no more than about equimolar with the concentration of the antibody or antigen-binding antibody fragment.

[0019] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 117.1 light chain polypeptide variable region (“117.1L”) comprising the amino acid sequence depicted in SEQ ID NO:27 (117.1L). In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 117.1 heavy chain polypeptide variable region (“117.1H”) comprising the amino acid sequence depicted in SEQ ID NO:28 (117.1H). In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:27 (117.1L) and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:28 (117.1H).

[0020] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 368.1 light chain polypeptide variable region (“368.1L”) comprising the amino acid sequence depicted in SEQ ID NO:29 (368.1L). In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 368.1 heavy chain variable region (“368.1H”) comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H). In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:29 (368.1L) and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H).

[0021] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 501.1 light chain polypeptide variable region (“501.1L”) comprising the amino acid sequence depicted in SEQ ID NO:31 (501.1L). In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 501.1 heavy chain variable region (“501.1H”) comprising the amino acid sequence depicted in SEQ ID NO:32 (501.1H). In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:31 (501.1L) and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:32 (501.1H).

[0022] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 776.1 light chain polypeptide variable region (“776.1L”) comprising the amino acid sequence depicted in SEQ ID NO:33 (776.1L). In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that

comprises a 776.1 heavy chain variable region (“776.1H”) comprising the amino acid sequence depicted in SEQ ID NO:34 (776.1H). In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:33 (776.1L) and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:34 (776.1H).

[0023] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 725.1 light chain polypeptide variable region (“725.1L”) comprising the amino acid sequence depicted in SEQ ID NO:54. In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 725.1 heavy chain variable region (“725.1H”) comprising the amino acid sequence depicted in SEQ ID NO:53. In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:54 and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:53.

[0024] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 16H9 light chain polypeptide variable region (“16H9L”) comprising the amino acid sequence depicted in SEQ ID NO:56. In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 16H9 heavy chain variable region (“16H9”) comprising the amino acid sequence depicted in SEQ ID NO:55. In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:56 and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:55.

[0025] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:27 (117.1L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H), SEQ ID NO:32 (501.1H), SEQ ID NO:34 (776.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55 (16H9H).

[0026] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:29 (368.1L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H),

SEQ ID NO:32 (501.1H), SEQ ID NO:34 (776.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55 (16H9H)

[0027] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:31 (501.1L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H), SEQ ID NO:32 (501.1H), SEQ ID NO:34 (776.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55 (16H9H)

[0028] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:33 (776.1L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H), SEQ ID NO:32 (501.1H), SEQ ID NO:34 (776.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55 (16H9H).

[0029] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:54 (725.1L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H), SEQ ID NO:32 (501.1H), SEQ ID NO:34 (776.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55 (16H9H).

[0030] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:33 (16H9L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H), SEQ ID NO:32 (501.1H), SEQ ID NO:34 (776.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55 (16H9H).

[0031] The antibodies of the invention can include, but are not limited to, polyclonal antibodies, monoclonal antibodies, chimeric antibodies, humanized antibodies, human antibodies, bi-specific antibodies, tri-specific antibodies, multi-specific antibodies, diabodies, tribodies, single-chain antibodies or anti-idiotypic antibodies. In a preferred embodiment, an antibody of the invention is a monoclonal antibody that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide.

[0032] The antigen-binding antibody fragments of the invention can include, but are not limited to, Fab fragments, F(ab')<sub>2</sub> fragments, disulfide-linked F<sub>v</sub>s, single-chain F<sub>v</sub>s,

variable light chain polypeptide (VL)-containing fragments, variable heavy chain polypeptide (VH)-containing fragments, or complementarity-determining region (CDR)-containing fragments, and fragments of any of the antibodies of the invention listed above.

[0033] Further, the antibodies and antigen-binding antibody fragments of the invention can be of any immunoglobulin class. For example, the antibodies of the invention can be IgG, IgM, IgE, IgD, IgA or IgY class antibodies. The antibodies of the invention can also be of any isotype. For example, an antibody of the invention can be of an IgG<sub>1</sub>, IgG<sub>2</sub>, IgG<sub>3</sub>, IgG<sub>4</sub>, IgA<sub>1</sub> or IgA<sub>2</sub> heavy chain isotype.

[0034] Still further, the antibodies of the invention, can, for example, comprise a variable light chain region, for example, a  $\kappa$  or  $\lambda$  light chain variable region, a variable heavy chain region, or a CDR thereof, inserted within a framework region. For example, an antibody of the invention can comprise a C $\gamma$ 1 constant region or a C $\gamma$ 4 constant region.

[0035] In another aspect, the present invention provides hybridoma cells that produce a monoclonal antibody of the invention. In one embodiment, a hybridoma of the present invention is hybridoma 4E7 (ATCC<sup>®</sup> Accession No. PTA-5109), hybridoma 7A11 (ATCC<sup>®</sup> Accession No. PTA-5110), hybridoma 7C6 (ATCC<sup>®</sup> Accession No. PTA-5111), hybridoma 7F10 (ATCC<sup>®</sup> Accession No. PTA-5112), hybridoma 7G10 (ATCC<sup>®</sup> Accession No. PTA-5245), hybridoma 7H1 (ATCC<sup>®</sup> Accession No. PTA-5114), hybridoma 8A1 (ATCC<sup>®</sup> Accession No. PTA-5115), hybridoma 8B5 (ATCC<sup>®</sup> Accession No. PTA-5116), hybridoma 8C3 (ATCC<sup>®</sup> Accession No. PTA-5246), hybridoma 8E3 (ATCC<sup>®</sup> Accession No. PTA-5118), hybridoma 8G9 (ATCC<sup>®</sup> Accession No. PTA-5119), hybridoma 15C9 (ATCC<sup>®</sup> Accession No. PTA-5106), hybridoma 16C7 (ATCC<sup>®</sup> Accession No. PTA-5107), hybridoma 16H9 (ATCC<sup>®</sup> Accession No. PTA-5108), hybridoma 117.1 (ATCC<sup>®</sup> Accession No. PTA-4567), hybridoma 325.1 (ATCC<sup>®</sup> Accession No. PTA-5120), hybridoma 368.1 (ATCC<sup>®</sup> Accession No. PTA-4568), hybridoma 446.1 (ATCC<sup>®</sup> Accession No. PTA-5549), hybridoma 501.1 (ATCC<sup>®</sup> Accession No. PTA-4569), hybridoma 621.1 (ATCC<sup>®</sup> Accession No. PTA-5121), hybridoma 633.1 (ATCC<sup>®</sup> Accession No. PTA-5122), hybridoma 654.1 (ATCC<sup>®</sup> Accession No. PTA-5247), hybridoma 725.1 (ATCC<sup>®</sup> Accession No. PTA-5124), or hybridoma 776.1 (ATCC<sup>®</sup> Accession No. PTA-4570).

[0036] In another embodiment, a hybridoma of the present invention is a hybridoma that produces monoclonal antibodies that compete with the monoclonal antibody produced by hybridoma 4E7 (ATCC<sup>®</sup> Accession No. PTA-5109), hybridoma 7A11 (ATCC<sup>®</sup> Accession No. PTA-5110), hybridoma 7C6 (ATCC<sup>®</sup> Accession No. PTA-5111), hybridoma 7F10 (ATCC<sup>®</sup> Accession No. PTA-5112), hybridoma 7G10 (ATCC<sup>®</sup> Accession No. PTA-5245),

hybridoma 7H1 (ATCC<sup>®</sup> Accession No. PTA-5114), hybridoma 8A1 (ATCC<sup>®</sup> Accession No. PTA-5115), hybridoma 8B5 (ATCC<sup>®</sup> Accession No. PTA-5116), hybridoma 8C3 (ATCC<sup>®</sup> Accession No. PTA-5246), hybridoma 8E3 (ATCC<sup>®</sup> Accession No. PTA-5118), hybridoma 8G9 (ATCC<sup>®</sup> Accession No. PTA-5119), hybridoma 15C9 (ATCC<sup>®</sup> Accession No. PTA-5106), hybridoma 16C7 (ATCC<sup>®</sup> Accession No. PTA-5107), hybridoma 16H9 (ATCC<sup>®</sup> Accession No. PTA-5108), hybridoma 117.1 (ATCC<sup>®</sup> Accession No. PTA-4567), hybridoma 325.1 (ATCC<sup>®</sup> Accession No. PTA-5120), hybridoma 368.1 (ATCC<sup>®</sup> Accession No. PTA-4568), hybridoma 446.1 (ATCC<sup>®</sup> Accession No. PTA-5549), hybridoma 501.1 (ATCC<sup>®</sup> Accession No. PTA-4569), hybridoma 621.1 (ATCC<sup>®</sup> Accession No. PTA-5121), hybridoma 633.1 (ATCC<sup>®</sup> Accession No. PTA-5122), hybridoma 654.1 (ATCC<sup>®</sup> Accession No. PTA-5247), hybridoma 725.1 (ATCC<sup>®</sup> Accession No. PTA-5124), or hybridoma 776.1 (ATCC<sup>®</sup> Accession No. PTA-4570). for binding to cell-associated CA 125/O772P. Antibodies are considered to compete for binding if they compete for binding in an ELISA Cross-Competition Assay and/or a FACS Cross-Competition Assay. An antibody or antigen-binding antibody fragment is considered to compete for binding in an ELISA Cross-Competition Assay or a FACS Cross-Competition Assay if the IC<sub>50</sub> for the competitor antibody or antigen-binding fragment is a concentration no more than about 100-fold above the concentration of the antibody or antigen-binding antibody fragment. In a preferred embodiment, the IC<sub>50</sub> of the competitor antibody or antigen-binding antibody fragment is a concentration no more than about 10-fold above the concentration of the antibody or antigen-binding fragment. In a more preferred embodiment, the IC<sub>50</sub> of the competitor antibody or antigen-binding antibody fragment is no more than about equimolar with the concentration of the antibody or antigen-binding antibody fragment.

[0037] In yet another aspect, the present invention provides an isolated nucleic acid molecule that comprises a nucleotide sequence that encodes an antibody or antigen-binding antibody fragment of the invention.

[0038] In another aspect, the present invention provides a fusion polypeptide comprising an antibody or an antigen-binding antibody fragment of the invention, *i.e.*, one that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide, operably linked to a heterologous agent. In one embodiment of a fusion polypeptide of the invention, the antibody, or antigen-binding antibody fragment, and the heterologous agent are operably linked via a covalent linkage, such as a peptide bond or disulfide bond. In another embodiment of a fusion polypeptide of the invention, the antibody, or antigen-binding antibody fragment, and the heterologous agent are operably

linked via non-covalent linkage. In another embodiment of a fusion polypeptide of the invention, the heterologous agent comprises an amino acid sequence or a radioisotope. In various non-limiting embodiments, the heterologous agent of the fusion polypeptide of the invention comprises a cytotoxic agent or a detectable, *e.g.*, imaging, agent.

[0039] Also included as part of the invention are analogs of the antibodies, antigen-binding antibody fragments and fusion polypeptides of the invention that preferentially bind cell-associated CA 125/O772P relative to shed CA 125/O772P. In one embodiment, such an analog exhibits increased affinity for cell-associated CA 125/O772P relative to that of a corresponding pre-modified antibody, antigen-binding antibody fragments and fusion polypeptide. In another embodiment, such an analog exhibits an increased serum half-life compared to a corresponding pre-modified antibody, antigen-binding antibody fragments and fusion polypeptide. For example, among the analogs of the invention are analogs of the monoclonal antibody produced hybridoma 4E7 (ATCC<sup>®</sup> Accession No. PTA-5109), or by hybridoma 7A11 (ATCC<sup>®</sup> Accession No. PTA-5110), or by hybridoma 7C6 (ATCC<sup>®</sup> Accession No. PTA-5111), or by hybridoma 7F10 (ATCC<sup>®</sup> Accession No. PTA-5112), or by hybridoma 7G10 (ATCC<sup>®</sup> Accession No. PTA-5245), or by hybridoma 7H1 (ATCC<sup>®</sup> Accession No. PTA-5114), or by hybridoma 8A1 (ATCC<sup>®</sup> Accession No. PTA-5115), or by hybridoma 8B5 (ATCC<sup>®</sup> Accession No. PTA-5116), or by hybridoma 8C3 (ATCC<sup>®</sup> Accession No. PTA-5246), or by hybridoma 8E3 (ATCC<sup>®</sup> Accession No. PTA-5118), or by hybridoma 8G9 (ATCC<sup>®</sup> Accession No. PTA-5119), or by hybridoma 15C9 (ATCC<sup>®</sup> Accession No. PTA-5106), or by hybridoma 16C7 (ATCC<sup>®</sup> Accession No. PTA-5107), or by hybridoma 16H9 (ATCC<sup>®</sup> Accession No. PTA-5108), or by hybridoma 117.1 (ATCC<sup>®</sup> Accession No. PTA-4567), or by hybridoma 325.1 (ATCC<sup>®</sup> Accession No. PTA-5120), or by hybridoma 368.1 (ATCC<sup>®</sup> Accession No. PTA-4568), or by hybridoma 446.1 (ATCC<sup>®</sup> Accession No. PTA-5549), or by hybridoma 501.1 (ATCC<sup>®</sup> Accession No. PTA-4569), or by hybridoma 621.1 (ATCC<sup>®</sup> Accession No. PTA-5121), or by hybridoma 633.1 (ATCC<sup>®</sup> Accession No. PTA-5122), or by hybridoma 654.1 (ATCC<sup>®</sup> Accession No. PTA-5247), or by hybridoma 725.1 (ATCC<sup>®</sup> Accession No. PTA-5124), or by hybridoma 776.1 (ATCC<sup>®</sup> Accession No. PTA-4570).

[0040] In another aspect, the present invention provides a pharmaceutical composition comprising an antibody, an antigen-binding antibody fragment, fusion polypeptide, or analog of the invention, that is, one that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide, and a pharmaceutically acceptable carrier. In still another aspect, the present invention provides a

method of preparing a pharmaceutical composition comprising admixing an antibody or antigen-binding antibody fragment of the invention with a pharmaceutically acceptable carrier.

[0041] In still another aspect, the present invention provides an article of manufacture comprising packaging material and a pharmaceutical composition of the invention contained within the packaging material, said pharmaceutical composition in a form suitable for administration to a subject, preferably a human. In one embodiment, the article of manufacture further comprises printed instructions and/or a label regarding the use or administration of the pharmaceutical composition. The instructions and/or label can, for example, suggest a dosing regimen for the prevention or treatment of one or more symptoms of a CA 125/O772P-related disorder, such as a cell proliferative disorder, for example cancer, *e.g.*, ovarian, uterine, breast, or lung cancer.

[0042] In another aspect, the present invention provides methods for preventing, treating, managing or ameliorating a symptom of a CA 125/O772P-related disorder, comprising: administering to a subject in need of such prevention, treatment, management, or amelioration, an antibody or antigen-binding fragment of an antibody in an amount sufficient to prevent, treat, manage, or ameliorate a symptom of the cell proliferative disorder, wherein said antibody or antigen-binding antibody fragment preferentially binds cell-associated CA 125/O772P relative to shed CA 125/O772P.

[0043] In one embodiment, such methods of the invention relate to prevention, treatment, management, or amelioration of a symptom of a cell proliferative disorder. In another embodiment, such methods of the invention relate to prevention, treatment, management, or amelioration of a symptom of a cancer. In yet another embodiment, such methods of the invention relate to prevention, treatment, management, or amelioration of a symptom of cervical cancer, uterine cancer, breast cancer or lung cancer. In a preferred embodiment of such methods of the invention, such methods relate to prevention, treatment, management, or amelioration of a symptom of ovarian cancer.

[0044] In one embodiment of such methods of the invention, the antibody or antigen-binding fragment administered is a monoclonal antibody or antigen-binding monoclonal antibody fragment. In another embodiment of the methods of the invention, the antibody or antigen-binding antibody fragment is administered at a dosage concentration of from about 5 $\mu$ g/kg to about 10mg/kg, preferably from about 20 $\mu$ g/kg to about 5mg/kg, and more preferably from about 100 $\mu$ g/kg to about 5mg/kg.



[0045] In yet another embodiment of such methods of the invention, the methods are practiced as part of a combination cancer therapy. Such combination cancer therapy can include, for example, administration of a chemotherapeutic agent, *e.g.*, paclitaxel or cisplatin. Such combination cancer therapy can alternatively include, but is not limited to, radiation therapy.

[0046] In still another aspect, the present invention provides a method to assist in identifying an antibody or antigen-binding antibody fragment that preferentially binds cell-associated CA 125/O772P relative to shed CA 125/O772P. In one embodiment, a method to assist in identifying an antibody or antigen-binding antibody fragment that preferentially binds cell-associated CA 125/O772P comprises contacting an antibody or antigen-binding antibody fragment with a peptide comprising cell-associated CA 125/O772P (*e.g.*, a cell-associated CA125/O772P polypeptide or even the full length CA125/O772P polypeptide) in the presence of shed CA 125/O772P (preferably an excess amount (weight/weight) of shed) under conditions that allow binding of the antibody or antigen-binding antibody fragment to either said peptide comprising cell-associated CA 125/O772P or shed CA 125/O772P. After incubating, the shed CA 125/O772P (with or without antibody or antigen-binding antibody fragment bound) and unbound antibody or antigen-binding antibody fragment are removed, and the amount of antibody or antigen-binding antibody fragment bound to the peptide comprising cell-associated CA 125/O772P is measured. If the antibody or antigen-binding antibody fragment from such method satisfies any one of the three embodiments set forth above for “preferentially binds,” then said antibody, or antigen-binding antibody fragment, is one that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide. In a preferred embodiment, the ratio of shed CA 125/O772P to cell-associated CA 125/O772P in the reaction mixture is about 25:1 (wt/wt). As part of this method, cell-associated CA 125/O772P can be immobilized on a solid surface. For example, the method can be performed in an ELISA format.

[0047] In still another embodiment, the invention provides a method to assist in identifying an antibody, or antigen-binding antibody fragment, that preferentially binds cell-associated CA 125/O772P relative to shed CA 125/O772P comprises contacting the antibody, or antigen-binding fragment, with a peptide comprising cell-associated CA 125/O772P and shed CA 125/O772P (preferably an excess amount (weight/weight) of shed), *e.g.*, about a 25-fold excess amount (wt/wt), under conditions that allow binding of the peptide comprising cell-associated CA 125/O772P to the antibody or antigen-binding antibody fragment, removing unbound peptide comprising cell-associated CA 125/O772P, measuring the amount

of peptide comprising cell-associated CA 125/O772P bound by the antibody, or antigen-binding fragment, and comparing the amount measured to the amount of peptide comprising cell-associated CA 125/O772P the antibody or antigen-binding antibody fragment can bind in the absence of such amount of shed CA 125/O772P (*i.e.*, a lesser amount). If the antibody or antigen-binding antibody fragment from such method satisfies any one of the three embodiments set forth above for “preferentially binds,” then said antibody or antigen-binding antibody fragment is one that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide. As part of this method the antibody, or antigen-binding antibody fragment can be immobilized on a solid surface, for example, the method can be performed in an ELISA format.

[0048] In yet another embodiment, the invention provides a method to assist in identifying an antibody, or antigen-binding antibody fragment, that preferentially binds cell-associated CA 125/O772P comprises contacting the antibody, or antigen-binding fragment, with a cell that expresses CA 125/O772P and with an amount, *e.g.*, at least about 0.05 mg/ml, of shed CA 125/O772P (preferably an excess of amount (wt/wt) of shed) under conditions that allow binding of the CA 125/O772P to the antibody or antigen-binding antibody fragment, removing unbound cells, measuring the amount of cells expressing CA 125/O772P bound by the antibody, or antigen-binding fragment, and comparing the amount measured to the amount of cells expressing CA 125/O772P that binds the antibody or antigen-binding antibody fragment in the absence of such amount of (*i.e.*, a lesser amount) shed CA 125/O772P. If the antibody or antigen-binding antibody fragment from such method satisfies any one of the three embodiments set forth above for “preferentially binds,” then said antibody or antigen-binding antibody fragment is one that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide. Such a method can, for example, be performed wherein the measuring is performed by flow cytometry techniques, including, *e.g.*, fluorescence activated cell sorting (FACS).

[0049] In another aspect, the present invention also provides methods for diagnosing a CA 125/O772P-related disorder or predisposition to a CA 125/O772P-related disorder.

### 3.1. Terminology

[0050] As used herein, the term “analog” in the context of an antibody or antigen-binding antibody fragment or fusion polypeptide of the invention refers to an antibody, antigen-binding antibody fragment or fusion polypeptide that is modified relative to a corresponding antibody, antigen-binding antibody fragment or fusion polypeptide of the invention (referred to in this context as a “pre-modified” antibody, antigen-binding antibody

fragment or fusion polypeptide of the invention) prior to the modification present in the analog, but which still preferentially binds cell-associated CA 125/O772P relative to shed CA 125/O772P.

[0051] “Affinity” ( $K_d$ ) of an antibody or antigen-binding antibody fragment of the invention is determined by the affinity assay described in Section 6.4, below.

[0052] The term “antibody of the invention,” as used herein, refers to an antibody that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide. Likewise, the term “antigen-binding antibody fragment of the invention,” as used herein, refers to an antigen-binding antibody fragment that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide. An antibody or antigen-binding antibody fragment is considered an antibody or antigen binding fragment of the invention even if it binds a CA 125/O772P polypeptide, *i.e.*, a pre-shed CA 125/O772P polypeptide, as long as such antibody or antigen-binding antibody fragment nonetheless preferentially binds cell-associated CA 125/O772P relative to shed CA 125/O772P. Due to the fact, as discussed below, that cell-associated CA 125/O772P, prior to CA 125/O772P shedding, is present as part of pre-shed CA 125/O772P, it is noted that antibodies that preferentially bind cell-associated CA 125/O772P can also bind pre-shed CA 125/O772P. Thus, independently of whether or not an antibody or antigen-binding antibody fragment binds CA 125/O772P, it is considered an antibody or antigen-binding antibody fragment of the invention so long as it satisfies the criteria set forth herein for “preferentially binds CA 125/O772P polypeptide relative to shed CA 125/O772P.” It is further noted that, unless otherwise indicated, the terms “antibody” and “immunoglobulin” are utilized interchangeably.

[0053] The term “Antibody-Dependent Cellular Cytotoxicity assay” (ADCC assay) as used herein, refers to the ADCC assay described in Section 6.5, below. As such, an antibody or antigen-binding antibody fragment that mediates lysis of CA 125/O772P-positive tumor cells in an ADCC assay is one that is considered positive when tested in the ADCC assay described in Section 6.5, below.

[0054] The term “about,” as used herein, unless otherwise indicated, refers to a value that is no more than 10% above or below the value being modified by the term. In the event a nucleic acid or amino acid sequence length is the value being modified, the resulting modified value will be an integer that is no more than 10% above or below the original length. Further, instances wherein 10% of the length being modified by this term results in a

value that must be less than 1, then it is understood that, as used herein, that the modified length is 1 nucleotide or amino acid residue more or less than the original value.

[0055] As used herein, the term “binds to” in the context of antibody-antigen binding, *e.g.*, in the context of an antibody or antigen-binding antibody fragment that preferentially binds cell-associated CA 125/O772P, refers to antibodies or antigen-binding antibody fragments that specifically bind to a particular antigen (*e.g.*, cell-associated CA 125/O772P) and do not specifically bind to other antigens. Preferably, an antibody or antigen-binding antibody fragment is one that binds CA 125/O772P with a specificity of at least 5 OD/microgram of antibody as determined by an ELISA Specificity Assay, or is considered positive in a Flow Cytometry Specificity Assay. A peptide or polypeptide that binds to an antigen may bind to other peptides or polypeptides with lower affinity as determined by, *e.g.*, immunoassays, BIAcore, Scatchard analysis or other assays known in the art. Antibodies or fragments that specifically bind to an antigen may be cross-reactive with related antigens. Preferably, antibodies or fragments that bind to an antigen do not cross-react with other antigens. See, *e.g.*, *Fundamental Immunology Second Edition*, Paul, ed., Raven Press (1989) at pages 332-336 for a discussion regarding antibody specificity. Preferably, an antibody or antigen-binding antibody fragment of the invention is one that binds the peptide of Figure 1 with a  $K_d$  of less than about 100 nM, and more preferably binds the peptide of Figure 1 with a  $K_d$  of less than about 5 nM, all as measured by the BIAcore Affinity Assay, which is described in Section 6.4. It is noted that an antibody that preferentially binds cell-associated CA 125/O772P may yet also represent an antibody that specifically binds CA 125/O772P, including shed CA 125/O772P, relative to other, non-CA 125/O772P antigens. Finally, it is noted that the terms “specifically” and “immunospecifically,” as used herein, unless otherwise noted, are used interchangeably.

[0056] ELISA Specificity Assay: This assay, as used herein, refers to the ELISA assay described in Section 6.2, below. An antibody (or antigen-binding antibody fragment) is considered positive in this assay (*i.e.*, is specific for CA 125/O772P) if it exhibits an absorbance of at least 5 to greater than 30 OD/microgram antibody.

[0057] Flow Cytometry Specificity Assay: This assay, as used herein, refers to the flow cytometry assay described in Section 6.2, below. Antibodies (or antigen-binding antibody fragments) are considered positive (*i.e.*, are specific for CA 125/O772P) if they exhibit a Flow Cytometry Specificity Assay result within the following positive cell ranges: less than 5% positive NIH/3T3 cells, and at least 60% positive NIH/3T3 cells producing a

SEQ ID NO:2 polypeptide; and/or less than 25% positive SK-OV3 cells and at least 80% positive OVCAR-3 cells.

[0058] The terms “competes for binding,” and “competes with” as used herein the context of two antibody species or antigen-binding antibody fragment species (or combinations thereof) are used interchangeably. A first antibody or antigen-binding antibody fragment is considered to compete with a second antibody or antigen-binding antibody fragment if the first antibody or antigen-binding antibody fragment competes with the second in an ELISA Cross-Competition Assay and/or a FACS Cross-Competition Assay.

[0059] ELISA Cross-Competition Assay: This assay, as used herein, refers to the ELISA assay described in Section 7.0, below. An antibody or antigen-binding antibody fragment is considered to compete for binding in this assay if the  $IC_{50}$  for the competitor antibody or antigen-binding antibody fragment is a concentration no more than about 100-fold above the concentration of the antibody or antigen-binding antibody fragment.

[0060] FACS Cross-Competition Assay: This assay, as used herein, refers to the FACS assay described in Section 7.0, below. An antibody or antigen-binding antibody fragment is considered to compete for binding in this assay if the  $IC_{50}$  for the competitor antibody or antigen-binding antibody fragment is a concentration no more than about 100-fold above the concentration of the antibody or antigen-binding antibody fragment.

[0061] The term “CA 125/O772P” or “CA 125/O772P polypeptide,” as used herein refers to the pre-shed CA 125/O772P, transmembrane polypeptide that, once shed, yields shed CA 125/O772P polypeptide and cell-associated CA 125/O772P polypeptide. The amino acid sequence reported in the literature as the full-length sequence of CA 125/O772P polypeptide has recently been shown to not, in fact, represent the full-length CA 125/O772P sequence. In particular, see, *e.g.*, WO 02/06317 (PCT/US01/22635), and US 2003/0124140, which disclose a polypeptide referred to as “O772P.” The amino acid sequence of O772P includes an extension over what was previously thought to be full-length CA 125. Because the polypeptide is referred to in the art as CA 125 or as O772P, it is referred to herein as “CA 125/O772P.”

[0062] As used herein, the term “CA 125/O772P-related disorder” refers to a disorder that involves or is characterized by the presence of a differential level of cell-associated CA 125/O772P relative to a corresponding normal state and/or an overabundance of shed CA 125/O772P relative to a corresponding normal state. For example, in the case of ovarian cancer, a higher level of cell-associated or shed CA 125/O772P is observed relative to the

level observed in a normal (*e.g.*, non-cancerous) state. The differential level of cell-associated and/or shed CA 125/O772P can either be causative or indicative of the disorder.

[0063] As used herein, the term “cell-associated CA 125/O772P” refers to a CA 125/O772P extracellular polypeptide species that remains in cell-associated form however transiently, *e.g.*, prior to turn-over, after a portion of the pre-shed CA 125/O772P polypeptide is released as shed CA 125/O772P. For example, a cell-associated CA 125/O772P species is a CA 125/O772P extracellular polypeptide species that remains in cell-associated form on the surface of OVCAR-3 cell line cells (HTB-161; ATCC®) or human ascites cells after a portion of the CA 125/O772P polypeptide is released as shed CA 125/O772P. A CA 125/O772P cell-associated polypeptide species is present within amino acid residues 1 to 708 of SEQ ID NO:1 and within amino acid residues 1 to 711 of SEQ ID NO:2. Moreover, CA 125/O772P may be cleaved at a protease cleavage site located at amino acid residues 659-665 of SEQ ID NO:2. See O’Brien *et al.*, *Tumour Biol.* 23(3):154-169 (2002). As such, a cell-associated CA 125/O772P polypeptide may include amino acid residues 659-711 of SEQ ID NO:2.

[0064] The term “Complement-Dependent Cytotoxicity assay” (CDC Assay) as used herein refers to the CDC assay described in Section 6.5, below. As such, an antibody or antigen-binding antibody fragment that mediates tumor cell lysis in a CDC assay is one that is considered positive when tested in the CDC assay described in Section 6.5, below.

[0065] As used herein, the terms “disorder” and “disease” are used interchangeably to refer to a condition in a subject.

[0066] As used herein, the term “fragment” in the phrase “antigen-binding antibody fragment” refers to a peptide or polypeptide comprising an amino acid sequence of at least about 5 contiguous amino acid residues, at least about 10 contiguous amino acid residues, at least about 15 contiguous amino acid residues, at least about 20 contiguous amino acid residues, at least about 25 contiguous amino acid residues, at least about 40 contiguous amino acid residues, at least about 50 contiguous amino acid residues, at least about 60 contiguous amino acid residues, at least about 70 contiguous amino acid residues, at least about 80 contiguous amino acid residues, at least about 90 contiguous amino acid residues, at least about 100 contiguous amino acid residues, at least about 110 contiguous amino acid residues, or at least about 120 contiguous amino acid residues, of the amino acid sequence of another polypeptide, *e.g.*, an antibody that preferentially binds cell-associated CA 125/O772P.

[0067] The term “host cell” as used herein refers to the particular cell, including a mammalian cell or other eukaryotic cells, or prokaryotic cells, said cells, for example, transformed or transfected with a nucleic acid molecule or infected with viruses, phagemid or

bacteriophage and the progeny or potential progeny of such a cell. Progeny of such a cell may not be identical to the parent cell transfected with the nucleic acid molecule due to mutations or environmental influences or additional recombinant manipulations that may occur in succeeding generations or integration of the nucleic acid molecule into the host cell genome.

[0068] As used herein, the term “hybridizes under stringent conditions” describes conditions for hybridization and washing under which nucleotide sequences at least 75% identical to each other typically remain hybridized to the complement of each other. Such stringent conditions are known to those skilled in the art and can be found in *Current Protocols in Molecular Biology*, Ausubel *et al.*, eds., John Wiley & Sons (1989-2002) at sections 6.3.1-6.3.6. In one, non-limiting example stringent hybridization conditions are hybridization at 6X sodium chloride/sodium citrate (SSC) at about 45°C, followed by one or more washes in 0.1XSSC, 0.2% SDS at about 68°C. In a preferred, non-limiting example stringent hybridization conditions are hybridization in 6XSSC at about 45°C, followed by one or more washes in 0.2 X SSC, 0.1% SDS at 50-65°C (*i.e.*, one or more washes at 50°C, 55°C, 60°C or 65°C). It is understood that in certain embodiments the nucleic acids of the invention do not include nucleic acid molecules that hybridize under these conditions solely to a nucleotide sequence consisting of only A or T nucleotides.

[0069] As used herein, the term “isolated” in the context of a peptide, polypeptide, fusion protein, antibody or antigen-binding antibody fragment refers to a peptide, polypeptide, fusion protein, antibody or antigen-binding antibody fragment which is substantially free of cellular material or contaminating proteins from the cell or tissue source from which it is derived or obtained, or substantially free of chemical precursors or other chemicals when chemically synthesized. The language “substantially free of cellular material or contaminating protein” includes preparations of a peptide, polypeptide, fusion protein, antibody or antigen-binding antibody fragment in which the peptide, polypeptide, fusion protein, antibody or antigen-binding antibody fragment is separated from cellular components of the cells from which it is isolated or recombinantly produced. Thus, a peptide, polypeptide, fusion protein, antibody or antigen-binding antibody fragment that is substantially free of cellular material or contaminating protein includes preparations of a peptide, polypeptide, fusion protein, antibody or antigen-binding antibody fragment having less than about 30%, about 20%, about 10%, or about 5% (by dry weight) of other protein. When the peptide, polypeptide, fusion protein, antibody or antigen-binding antibody

fragment is recombinantly produced, it is also preferably substantially free of culture medium, *i.e.*, culture medium represents less than about 20%, about 10%, or about 5% of the volume of the protein preparation. When the peptide, polypeptide, fusion protein, antibody or antigen-binding antibody fragment is produced by chemical synthesis, it is preferably substantially free of chemical precursors or other chemicals, *i.e.*, it is separated from chemical precursors or other chemicals which are involved in the synthesis of the peptide, polypeptide, fusion protein, antibody or antigen-binding antibody fragment. Accordingly, such preparations of a peptide, polypeptide, fusion protein, antibody or antigen-binding antibody fragment have less than about 30%, about 20%, about 10%, about 5% (by dry weight) of chemical precursors or compounds other than the peptide, polypeptide, fusion protein, antibody or antigen-binding antibody fragment of interest.

[0070] As used herein, the term “isolated” in the context of nucleic acid molecules refers to a nucleic acid molecule which is separated from other nucleic acid molecules which are present in the natural cellular source of the nucleic acid molecule. Alternatively, an “isolated” nucleic acid molecule, such as a cDNA molecule, can be substantially free of other cellular material, or culture medium when produced by recombinant techniques, or substantially free of chemical precursors or other chemicals when chemically synthesized.

[0071] As used herein, the terms “manage,” “managing” and “management” refer to the beneficial effects that a subject derives from an agent, *e.g.*, an antibody, antigen-binding antibody fragment, fusion polypeptide or analog of the invention, which does not result in a cure of the disease. In certain embodiments, a subject is administered one or more such agents to “manage” a disorder so as to prevent or slow the progression or worsening of the disorder.

[0072] As used herein, the term “monoclonal antibody” refers to an antibody that is derived from a single cellular clone, including any eukaryotic, prokaryotic, or phage clone, and is not dependent upon the method by which it is produced. Therefore, a “monoclonal antibody” can refer to a composition comprising a population of antibodies that each bind to a single epitope wherein said composition lacks antibodies that bind a different epitope than the single epitope to which the population of antibodies bind. It is noted, of course, that in certain instances, a single epitope is present in a polypeptide at multiple positions. In such instances, although the monoclonal antibody may bind to multiple positions, it is, nonetheless, still considered to be binding to a single epitope.

[0073] As used herein, the terms “nucleic acids” and “nucleotide sequences” include DNA molecules (*e.g.*, cDNA or genomic DNA), RNA molecules (*e.g.*, mRNA),



combinations of DNA and RNA molecules or hybrid DNA/RNA molecules, and analogs of DNA or RNA molecules. Such analogs can be generated using, for example, nucleotide analogs, which include, but are not limited to, inosine or tritylated bases. Such analogs can also comprise DNA or RNA molecules comprising modified backbones that lend beneficial attributes to the molecules such as, for example, nuclease resistance or an increased ability to cross cellular membranes. The nucleic acids or nucleotide sequences can be single-stranded, double-stranded, may contain both single-stranded and double-stranded portions, and may contain triple-stranded portions, but preferably are double-stranded DNA.

[0074] The term “operably linked” as used herein the context of a fusion polypeptide refers to any covalent or non-covalent interaction that connects the antibody or antigen-binding antibody fragment to the heterologous agent. The operable linkage can be direct or indirect. For example, an amino acid sequence can be present between the antibody (or antigen-binding antibody fragment) and the heterologous agent.

[0075] As used herein, an antibody, antigen-binding antibody fragment, fusion polypeptide, or analog that “preferentially binds cell-associated CA 125/O772P,” “preferentially binds cell-associated CA 125/O772P polypeptide,” “preferentially binds cell-associated CA 125/O772P relative to shed CA 125/O772P” or “preferentially binds CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide” refers to an antibody or antigen-binding antibody fragment that is positive when tested in an ELISA Competition Assay or a Flow Cytometry Competition Assay, as described herein. Preferably, the antibody or antigen-binding antibody fragment is one that is positive in both an ELISA Competition Assay and a Flow Cytometry Competition Assay, as described herein.

[0076] ELISA Competition Assay: This assay, as used herein, refers to the ELISA assay described in Section 6.3, below. An antibody (or antigen-binding antibody fragment) is considered positive in this assay (that is, preferentially binds cell-associated CA 125/O772P) if it exhibits less than about 25% inhibition of binding at 25-fold w/w excess of shed CA 125/O772P over the peptide of Figure 1 (SEQ ID NO: 1).

[0077] Flow Cytometry Competition Assay: This assay, as used herein, refers to the flow cytometry assay described in Section 6.3, below. An antibody (or antigen-binding antibody fragment) is considered positive (that is, is considered to preferentially bind cell-associated CA 125/O772P) if it exhibits an  $IC_{50}$ , as measured by percent-positive cells, of at least 0.05 mg/ml shed CA 125/O772P, that is, if it requires at least 0.05 mg/ml shed CA 125/O772P to reduce the percent-positive cells in the Flow Cytometry Competition Assay by half.

[0078] As used herein, the terms “prevent”, “preventing” and “prevention” refer to the impidition of the recurrence or onset of a CA 125/O772P-related disorder or one or more symptoms of a CA 125/O772P-related disorder in a subject.

[0079] As used herein, a “protocol” includes dosing schedules and dosing regimens. The protocols herein are methods of use and include prophylactic and therapeutic protocols.

[0080] As used herein, the term “shed CA 125/O772P polypeptide” refers to a CA 125/O772P extracellular polypeptide sequence that becomes separated and released from CA 125/O772P polypeptides expressed on the surface of cells expressing CA 125/O772P, leaving a cell-associated CA 125/O772P species remaining on the cell surface, however transiently. The term, as used herein, refers to a species of shed CA 125/O772P found in human serum and/or OVCAR-3 (HTB-161; ATCC) cell line culture supernatant. Such shed CA 125/O772P polypeptides can be obtained via the protocol of de los Frailes *et al.*, Tumour Biol. 14(1):18-29 (1993), using human ascites or OVCAR-3 supernatants. Alternatively, shed CA 125/O772P polypeptides can be obtained via commercial sources such as Fitzgerald Industries International (Concord, MA), Scripps Laboratories (La Jolla, CA), or United States Biochemical Corp (Cleveland, OH).

[0081] As used herein, the terms “subject” and “patient” are used interchangeably. As used herein, the terms “subject” and “subjects” refer to an animal, preferably a mammal including a non-primate (*e.g.*, a cow, pig, horse, donkey, goat, camel, cat, dog, guinea pig, rat, mouse, sheep) and a primate (*e.g.*, a monkey, such as a cynomolgous monkey, gorilla, chimpanzee, and a human), preferably a human. In one embodiment, the subject is a subject with cancer, for example, ovarian cancer.

[0082] As used herein, the terms “treat”, “treatment” and “treating” refer to the amelioration of a CA 125/O772P-related disorder that results from the administration of one or more antibodies, antigen-binding antibody fragments, fusion polypeptides or analogs.

[0083] The term “pharmaceutically acceptable” as used herein means a composition, *e.g.*, a carrier, excipient, or salt, approved by a regulatory agency of the Federal or a state government or listed in the U.S. Pharmacopoeia or other generally recognized pharmacopoeia for use in animals, and more particularly, in humans.

#### 4. BRIEF DESCRIPTION OF THE DRAWINGS

[0084] FIG. 1: Depicts the amino acid sequence of CA 125/O772P 3-repeat (SEQ ID NO:1). Italicized residues from amino acid 14 to amino acid 452 represent repeat regions. Each of the three repeats within the 14-452 repeat region are delineated by vertical lines and arrows as shown. Underlined residues represent the transmembrane-proximal non-repeat

region. The sequence that follows the underlined residues is not part of CA 125/O772P and includes a carboxy-Myc-His tag.

[0085] FIG. 2: Depicts the amino acid sequence of CA 125/O772P 3-repeat TM (SEQ ID NO:2). Italicized, underlined residues, *i.e.*, from amino acid 14 to amino acid 452, represent repeat regions. Each of the three repeats within the 14-452 repeat region are delineated by vertical lines and arrows as shown. Underlined non-italicized residues, *i.e.*, from amino acid 453 to amino acid 711, represent the transmembrane-proximal non-repeat region. Non-underlined italicized residues, *i.e.*, from amino acid 712 to amino acid 738, represent the transmembrane domain. Residues in bold, *i.e.*, from amino acid 739 to amino acid 769, represent a cytoplasmic region. The sequence that follows the bold residues is not part of CA 125/O772P and includes a carboxy-Myc-His tag.

[0086] FIG. 3: Shows a representative plot from a FACS competition assay of shed CA 125/O772P concentrations versus percent positive cells for, in this instance, 117.1 antibody and M11 antibody control (squares). As shown, M11 can be competed for binding to OVCAR-3 cells even at low concentrations of shed CA 125/O772P ( $IC_{50} = 0.003\text{mg/ml}$ ) while 117.1 cannot be competed, even at high concentrations of shed CA 125/O772P ( $IC_{50}$  greater than  $1\text{mg/ml}$ ).

[0087] FIG. 4: Shows a representative plot from an ADCC assay of percent lysis versus antibody concentration for 117.1 antibody (average of 4 separate donors). As shown in the figure, antibody 117.1 mediates specific lysis of OVCAR-3 cells in a dose-dependent manner.

[0088] FIG. 5A: Depicts the nucleotide sequence (SEQ ID NO:35) that encodes the variable light chain region of monoclonal antibody 117.1. The nucleotide sequence that encodes leader sequence is double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0089] FIG. 5B: Depicts the nucleotide sequence (SEQ ID NO:36) that encodes the variable heavy chain region of monoclonal antibody 117.1. The nucleotide sequence that encodes leader sequence is double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0090] FIG. 5C: Depicts the amino acid sequence (SEQ ID NO:27) of the variable light chain region of monoclonal antibody 117.1. Leader sequence is double underlined, and CDR sequences are single underlined.

[0091] FIG. 5D: Depicts the amino acid sequence (SEQ ID NO:28) of the variable heavy chain region of monoclonal antibody 117.1. Leader sequence is double underlined, and CDR sequences are single underlined.

[0092] FIG. 6A: Depicts the nucleotide sequence (SEQ ID NO:37) that encodes the variable light chain region of monoclonal antibody 368.1. The nucleotide sequence that encodes leader sequence is double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0093] FIG. 6B: Depicts the nucleotide sequence (SEQ ID NO:38) that encodes the variable heavy chain region of monoclonal antibody 368.1. The nucleotide sequence that encodes leader sequence is double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0094] FIG. 6C: Depicts the amino acid sequence (SEQ ID NO:29) of the variable light chain region of monoclonal antibody 368.1. Leader sequence is double underlined, and CDR sequences are single underlined.

[0095] FIG. 6D: Depicts the amino acid sequence (SEQ ID NO:30) of the variable heavy chain region of monoclonal antibody 368.1. Leader sequence is double underlined, and CDR sequences are single underlined.

[0096] FIG. 7A: Depicts the nucleotide sequence (SEQ ID NO:39) that encodes the variable light chain region of monoclonal antibody 501.1. The nucleotide sequence that encodes leader sequence is double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0097] FIG. 7B: Depicts the nucleotide sequence (SEQ ID NO:40) that encodes the variable heavy chain region of monoclonal antibody 501.1. The nucleotide sequence that encodes leader sequences are double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0098] FIG. 7C: Depicts the amino acid sequence (SEQ ID NO:31) of the variable light chain region of monoclonal antibody 501.1. Leader sequence is double underlined, and CDR sequences are single underlined.

[0099] FIG. 7D: Depicts the amino acid sequence (SEQ ID NO:32) of the variable heavy chain region of monoclonal antibody 501.1. Leader sequences is double underlined, and CDR sequences are single underlined.

[0100] FIG. 8A: Depicts the nucleotide sequence (SEQ ID NO:41) that encodes the variable light chain region of monoclonal antibody 776.1. The nucleotide sequence that

encodes leader sequence is double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0101] FIG. 8B: Depicts the nucleotide sequence (SEQ ID NO:42) that encodes the variable heavy chain region of monoclonal antibody 776.1. The nucleotide sequences that encode leader sequences is double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0102] FIG. 8C: Depicts the amino acid sequence (SEQ ID NO:33) of the variable light chain region of monoclonal antibody 776.1. Leader sequence is double underlined, and CDR sequences are single underlined.

[0103] FIG. 8D: Depicts the amino acid sequence (SEQ ID NO:34) of the variable heavy chain region of monoclonal antibody 776.1. Leader sequence is double underlined, and CDR sequences are single underlined.

[0104] FIG. 9A: Depicts the nucleotide sequence (SEQ ID NO:52) that encodes the variable light chain region of monoclonal antibody 725.1. The nucleotide sequence that encodes leader sequence is double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0105] FIG. 9B: Depicts the nucleotide sequence (SEQ ID NO:57) that encodes the variable heavy chain region of monoclonal antibody 725.1. The nucleotide sequences that encode leader sequences is double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0106] FIG. 9C: Depicts the amino acid sequence (SEQ ID NO:54) of the variable light chain region of monoclonal antibody 725.1. Leader sequence is double underlined, and CDR sequences are single underlined.

[0107] FIG. 9D: Depicts the amino acid sequence (SEQ ID NO:53) of the variable heavy chain region of monoclonal antibody 725.1. Leader sequence is double underlined, and CDR sequences are single underlined.

[0108] FIG. 10A: Depicts the nucleotide sequence (SEQ ID NO:59) that encodes the variable light chain region of monoclonal antibody 16H9. The nucleotide sequence that encodes leader sequence is double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0109] FIG. 10B: Depicts the nucleotide sequence (SEQ ID NO:58) that encodes the variable heavy chain region of monoclonal antibody 16H9. The nucleotide sequences that encode leader sequences is double underlined, and the nucleotide sequences that encode CDR sequences are single underlined.

[0110] FIG. 10C: Depicts the amino acid sequence (SEQ ID NO:56) of the variable light chain region of monoclonal antibody 16H9. Leader sequence is double underlined, and CDR sequences are single underlined.

[0111] FIG. 10D: Depicts the amino acid sequence (SEQ ID NO:55) of the variable heavy chain region of monoclonal antibody 16H9. Leader sequence is double underlined, and CDR sequences are single underlined.

[0112] FIG. 11: Depicts the results of a western blot analysis of OVCAR-3 supernatants. Antibody concentration and detection are indicated in the working example presented, below, in Section 6.7. "3 Rpt Ptn" in each blot refers to lanes containing O772P 3-repeat recombinant polypeptide; the remainder of the lanes in each blot contain OVCAR-3 conditioned or control media. The particular antibody tested is indicated at the bottom of each blot (*i.e.*, M11, OC125, 776.1 and 368.1 antibodies). Molecular weight markers are indicated on left of figure.

[0113] FIG. 12: *In vivo* evaluation of  $^{131}\text{I}$ -labeled 776.1. NCR *nu/nu* mice bearing OVCAR-3 tumors were treated with either saline, 100  $\mu\text{Ci}$  [ $^{131}\text{I}$ ]776.1 IgG1, 300  $\mu\text{Ci}$  [ $^{131}\text{I}$ ]776.1 IgG1, or 17  $\mu\text{g}$  unlabeled 776.1 IgG1 (same protein dose as in the 300  $\mu\text{Ci}$  [ $^{131}\text{I}$ ]776.1 IgG1 group). Treatment was a single dose administered intravenously on day 0. The specific activity of [ $^{131}\text{I}$ ]776.1 was 15 mCi/mg with an immunoreactivity of 51% post-labeling. Results are shown as mean tumor volume $\pm$ SD for 10 mice total per group. Mean tumor size at the beginning of treatment was 199 mm<sup>3</sup> for all groups.

## 5. DETAILED DESCRIPTION OF THE INVENTION

[0114] The present invention is based, in part, on the recognition that the events that produce shed CA 125/O772P also leave a portion of the extracellular region of the CA 125/O772P amino acid sequence in cell-associated form, *i.e.*, also yield cell-associated CA 125/O772P. The invention described in detail herein is based, in part, on the recognition that antibodies, and antigen-binding antibody fragments, fusion polypeptides and analogs that preferentially bind cell-associated CA 125/O772P relative to shed CA 125/O772P can be generated, and that such antibodies, antigen-binding antibody fragments, fusion polypeptides and analogs can, for example, be utilized to prevent, manage, treat, or ameliorate a CA 125/O772P-related disorder or one or more symptoms of a CA 125/O772P-related disorder such as a cell proliferative disorder, for example, cancer, *e.g.*, ovarian cancer.

[0115] As discussed throughout, the antibodies and antigen-binding antibody fragments of the invention are those that preferentially bind cell-associated CA 125/O772P.

Likewise the fusion polypeptides and analogs of the invention also preferentially bind cell-associated CA 125/O772P. As also noted herein, due to the fact that cell-associated CA 125/O772P, prior to CA 125/O772P shedding, is present as part of pre-shed CA 125/O772P, it is noted that antibodies, antigen-binding antibody fragments, fusion polypeptides, and analogs of the invention can also bind pre-shed CA 125/O772P. Thus, while not wishing to be bound by any particular mechanism or theory thereof, it is noted that the methods described in this section can be effectuated by binding of the administered antibody, antigen-binding antibody fragments, fusion polypeptides, or analogs of the invention to pre-shed CA 125/O772P in addition to, or instead of, their binding to cell-associated CA 125/O772P.

**5.1. Antibodies and Antigen-Binding Antibody Fragments of the Invention**

[0116] In a first aspect, the present invention provides an isolated antibody, or an antigen-binding antibody fragment, that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide. Such antibodies and antigen-binding antibody fragments of the invention are useful for a variety of therapeutic, prophylactic, diagnostic, and purification purposes as described herein.

[0117] In one embodiment, an antibody or antigen-binding antibody fragment of the invention is one that binds SEQ ID NO:1 or SEQ ID NO:2 and which preferentially binds cell-associated CA 125/O772P. In one particular such embodiment, the antibody or antigen-binding antibody fragment of the invention binds the non-repeat region depicted in SEQ ID NO:1 or SEQ ID NO:2. In another such embodiment, the antibody or antigen-binding antibody fragment of the invention binds a repeat region depicted in SEQ ID NO:1 or SEQ ID NO:2.

[0118] In a first embodiment, the antibody or antigen-binding antibody fragment of the invention exhibits, in an ELISA Competition Assay, less than about 25%, less than about 20%, less than about 15%, less than about 10%, or less than about 5% inhibition of binding to the peptide of Figure 1 in the presence of a 25-fold (weight/weight) excess of shed CA 125/O772P over the peptide of Figure 1. In a second embodiment, the antibody or antigen-binding antibody fragment of the invention exhibits, in a Flow Cytometry Competition Assay, an IC<sub>50</sub>, as measured by percent-positive cells, of at least about 0.05 mg/ml, at least about 0.1 mg/ml, at least about 0.25 mg/ml, at least about 0.5 mg/ml, at least about 0.75 mg/ml, or at least about 1.0 mg/ml shed CA 125/O772P. In a third embodiment, the antibody or antigen-binding antibody fragment of the invention binds the peptide of Figure 1, but does not detectably bind shed CA 125/O772P polypeptide. An antibody, antigen-binding antibody fragment, that satisfies any one of these three embodiments

constitutes an antibody or antigen-binding antibody fragment that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide.

[0119] Among the antibodies and antigen-binding antibody fragments of the invention are antibodies or antigen-binding antibody fragments that bind the peptide of Figure 1 (SEQ ID NO: 1) with a  $K_d$  of less than about 100 nM, less than about 10 nM, less than about 1 nM, less than about 100 pM, or less than about 10 pM as measured by the BIAcore Affinity Assay, which is described in Section 6.4., hereinbelow.

[0120] Among the preferred embodiments of the antibodies or antigen-binding antibody fragments of the invention are antibodies or antigen-binding antibody fragments that mediate lysis of CA 125/O772P-positive tumor cells in an ADCC assay. Such antibodies or antigen-binding antibody fragments include, for example, those that mediate at least about 10%, at least about 20%, at least about 30%, at least about 40% or at least about 50% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 50:1 effector:target ratio at a concentration of 5  $\mu$ g antibody or antigen-binding fragment per ml; mediate at least about 10%, at least about 20%, at least about 30%, at least about 40% or at least about 50% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 25:1 effector:target ratio at a concentration of 5  $\mu$ g antibody or antigen-binding fragment per ml; mediate at least about 10%, at least about 20%, at least about 30%, at least about 40% or at least about 50% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 12.5:1 effector:target ratio at a concentration of 5  $\mu$ g antibody or antigen-binding fragment per ml; mediate at least about 10%, at least about 20%, at least about 30%, at least about 40% or at least about 50% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 12.5:1 effector:target ratio at a concentration of 0.5  $\mu$ g antibody or antigen-binding fragment per ml; or mediate at least about 10%, at least about 20%, at least about 30%, at least about 40%, or at least about 50% lysis of CA 125/O772P-positive tumor cells in an ADCC assay at a 12.5:1 effector:target ratio at a concentration of 50 ng antibody or antigen-binding fragment per ml.

[0121] Preferred embodiments of the invention also include antibodies or antigen-binding antibody fragments that mediate lysis of CA 125/O772P-positive tumor cells in a complement-dependent cytotoxicity (CDC) assay. Such antibodies or antigen-binding antibody fragments include, for example, those that mediate lysis in a range of about 15% lysis at 5  $\mu$ g/ml to about 95% lysis at 0.1  $\mu$ g/ml.

[0122] Preferred embodiments of the antibodies or antigen-binding antibody fragments of the invention also include antibodies and antigen-binding antibody fragments that inhibit CA 125/O772P-positive tumor growth. For example, such antibodies or antigen-binding



antibody fragments are those that, preferably, inhibit CA 125/O772P-positive tumor growth in such animal models as the ones described in Treskes *et al.*, Eur. J. Cancer. 30A(2):183-187 (1994); Ahmad *et al.*, Oncol. Res. 11(6):273-280 (1999); and Kievit *et al.*, Int. J. Radiat. Oncol. Biol. Phys. 38(2):419-428 (1997), and the OVCAR-3 xenograft tumor animal model described in Section 6.8, below.

[0123] In one particular embodiment, an antibody of the invention is a monoclonal antibody produced by hybridoma 4E7 (ATCC<sup>®</sup> Accession No. PTA-5109), or by hybridoma 7A11 (ATCC<sup>®</sup> Accession No. PTA-5110), or by hybridoma 7C6 (ATCC<sup>®</sup> Accession No. PTA-5111), or by hybridoma 7F10 (ATCC<sup>®</sup> Accession No. PTA-5112), or by hybridoma 7G10 (ATCC<sup>®</sup> Accession No. PTA-5245), or by hybridoma 7H1 (ATCC<sup>®</sup> Accession No. PTA-5114), or by hybridoma 8A1 (ATCC<sup>®</sup> Accession No. PTA-5115), or by hybridoma 8B5 (ATCC<sup>®</sup> Accession No. PTA-5116), or by hybridoma 8C3 (ATCC<sup>®</sup> Accession No. PTA-5246), or by hybridoma 8E3 (ATCC<sup>®</sup> Accession No. PTA-5118), or by hybridoma 8G9 (ATCC<sup>®</sup> Accession No. PTA-5119), or by hybridoma 15C9 (ATCC<sup>®</sup> Accession No. PTA-5106), or by hybridoma 16C7 (ATCC<sup>®</sup> Accession No. PTA-5107), or by hybridoma 16H9 (ATCC<sup>®</sup> Accession No. PTA-5108), or by hybridoma 117.1 (ATCC<sup>®</sup> Accession No. PTA-4567), or by hybridoma 325.1 (ATCC<sup>®</sup> Accession No. PTA-5120), or by hybridoma 368.1 (ATCC<sup>®</sup> Accession No. PTA-4568), or by hybridoma 446.1 (ATCC<sup>®</sup> Accession No. PTA-5549) Accession No. PTA-4569), or by hybridoma 501.1 (ATCC<sup>®</sup> Accession No. PTA-4569), or by hybridoma 621.1 (ATCC<sup>®</sup> Accession No. PTA-5121), or by hybridoma 633.1 (ATCC<sup>®</sup> Accession No. PTA-5122), or by hybridoma 654.1 (ATCC<sup>®</sup> Accession No. PTA-5247), or by hybridoma 725.1 (ATCC<sup>®</sup> Accession No. PTA-5124), or by hybridoma 776.1 (ATCC<sup>®</sup> Accession No. PTA-4570).

[0124] In another particular embodiment, an antibody or antigen-binding antibody fragment of the invention is an antibody or antigen-binding antibody fragment that competes with the monoclonal antibody produced by hybridoma 4E7 (ATCC<sup>®</sup> Accession No. PTA-5109), or by hybridoma 7A11 (ATCC<sup>®</sup> Accession No. PTA-5110), or by hybridoma 7C6 (ATCC<sup>®</sup> Accession No. PTA-5111), or by hybridoma 7F10 (ATCC<sup>®</sup> Accession No. PTA-5112), or by hybridoma 7G10 (ATCC<sup>®</sup> Accession No. PTA-5245), or by hybridoma 7H1 (ATCC<sup>®</sup> Accession No. PTA-5114), or by hybridoma 8A1 (ATCC<sup>®</sup> Accession No. PTA-5115), or by hybridoma 8B5 (ATCC<sup>®</sup> Accession No. PTA-5116), or by hybridoma 8C3 (ATCC<sup>®</sup> Accession No. PTA-5246), or by hybridoma 8E3 (ATCC<sup>®</sup> Accession No. PTA-5118), or by hybridoma 8G9 (ATCC<sup>®</sup> Accession No. PTA-5119), or by hybridoma 15C9 (ATCC<sup>®</sup> Accession No. PTA-5106), or by hybridoma 16C7 (ATCC<sup>®</sup> Accession No. PTA-

5107), or by hybridoma 16H9 (ATCC<sup>®</sup> Accession No. PTA-5108), or by hybridoma 117.1 (ATCC<sup>®</sup> Accession No. PTA-4567), or by hybridoma 325.1 (ATCC<sup>®</sup> Accession No. PTA-5120), or by hybridoma 368.1 (ATCC<sup>®</sup> Accession No. PTA-4568), or by hybridoma 446.1 (ATCC<sup>®</sup> Accession No. PTA-5549), or by hybridoma 501.1 (ATCC<sup>®</sup> Accession No. PTA-4569), or by hybridoma 621.1 (ATCC<sup>®</sup> Accession No. PTA-5121), or by hybridoma 633.1 (ATCC<sup>®</sup> Accession No. PTA-5122), or by hybridoma 654.1 (ATCC<sup>®</sup> Accession No. PTA-5247), or by hybridoma 725.1 (ATCC<sup>®</sup> Accession No. PTA-5124), or by hybridoma 776.1 (ATCC<sup>®</sup> Accession No. PTA-4570) for binding to cell-associated CA 125/O772P.

Antibodies or antibody-binding antibody fragments of the invention are considered to compete for binding if they compete for binding in an ELISA Cross-Competition Assay and/or a FACS Cross-Competition Assay. An antibody or antigen-binding antibody fragment is considered to compete for binding in an ELISA Cross-Competition Assay or a FACS Cross-Competition Assay if the IC<sub>50</sub> for the competitor antibody or antigen-binding fragment is a concentration no more than about 100-fold above the concentration of the antibody or antigen-binding antibody fragment. In a preferred embodiment, the IC<sub>50</sub> of the competitor antibody or antigen-binding antibody fragment is a concentration no more than about 10-fold above the concentration of the antibody or antigen-binding fragment. In a more preferred embodiment, the IC<sub>50</sub> of the competitor antibody or antigen-binding antibody fragment is no more than about equimolar with the concentration of the antibody or antigen-binding antibody fragment.

[0125] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:27 (117.1L). In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:28 (117.1H). In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:27 (117.1L) and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:28 (117.1H).

[0126] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:29 (368.1L). In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises

a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H). In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:29 (368.1L) and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H).

[0127] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:31 (501.1L). In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:32 (501.1H). In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:31 (501.1L) and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:32 (501.1H).

[0128] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:33 (776.1L). In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:34 (776.1H). In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:33 (776.1L) and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:34 (776.1H).

[0129] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 725.1 light chain polypeptide variable region ("725.1L") comprising the amino acid sequence depicted in SEQ ID NO:54. In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 725.1 heavy chain variable region ("725.1H") comprising the amino acid sequence depicted in SEQ ID NO:53. In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region

comprising the amino acid sequence depicted in SEQ ID NO:54 and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:53.

[0130] In another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 16H9 light chain polypeptide variable region ("16H9L") comprising the amino acid sequence depicted in SEQ ID NO:56. In yet another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a 16H9 heavy chain variable region ("16H9H") comprising the amino acid sequence depicted in SEQ ID NO:55. In still another particular embodiment, an antibody or antigen-binding fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:56 and a heavy chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:55.

[0131] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:27 (117.1L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H), SEQ ID NO:32 (501.1H), SEQ ID NO:34 (776.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55(16H9H).

[0132] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:29 (368.1L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:28 (117.1H), SEQ ID NO:32 (501.1H), SEQ ID NO:34 (776.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55(16H9H).

[0133] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:31 (501.1L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:28 (117.1H), SEQ ID NO:30 (368.1H), SEQ ID NO:34 (776.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55(16H9H).

[0134] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:33 (776.1L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:28 (117.1H),

SEQ ID NO:30 (368.1H), SEQ ID NO:32 (501.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55(16H9H).

[0135] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:54 (725.1L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H), SEQ ID NO:32 (501.1H), SEQ ID NO:34 (776.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55 (16H9H).

[0136] In another particular embodiment, the antibody or antigen-binding antibody fragment of the invention is one that comprises a light chain polypeptide variable region comprising the amino acid sequence depicted in SEQ ID NO:33 (16H9L) and a heavy chain variable region comprising the amino acid sequence depicted in SEQ ID NO:30 (368.1H), SEQ ID NO:32 (501.1H), SEQ ID NO:34 (776.1H), SEQ ID NO:53 (725.1H), or SEQ ID NO:55 (16H9H).

[0137] In one particular embodiment, an antibody or antigen-binding antibody fragment of the invention comprises a variable light chain region comprising any one, two or three VL CDRs depicted in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6. In another particular embodiment, an antibody or antigen-binding antibody fragment of the invention comprises a variable heavy chain region comprising any one, two or three VH CDRs depicted in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6. In yet another particular embodiment, an antibody or antigen-binding antibody fragment of the invention comprises a variable light chain region comprising any one, two or three VL CDRs depicted in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6 and a variable heavy chain region comprising any one, two or three VH CDRs depicted in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6.

[0138] In a preferred embodiment, an antibody or antigen-binding antibody fragment of the invention comprises a variable light chain region comprising any two or three VL CDRs depicted in Table 1; or any two or three VL CDRs depicted in Table 2; or any two or three VL CDRs depicted in Table 3; or any two or three VL CDRs depicted in Table 4; or any two or three VL CDRs depicted in Table 5; or any two or three VL CDRs depicted in Table 6. In another preferred embodiment, an antibody or antigen-binding antibody fragment of the invention comprises a variable heavy chain region comprising any two or three VH CDRs depicted in Table 1; or any two or three VH CDRs depicted in Table 2; or any two or three VH CDRs depicted in Table 3; or any two or three VH CDRs depicted in Table 4; or

any two or three VH CDRs depicted in Table 5; or any two or three VH CDRs depicted in Table 6.

[0139] In yet another preferred embodiment, an antibody or antigen-binding antibody fragment of the invention comprises a variable light chain region and a variable heavy chain region, said variable light chain region comprising any two or three VL CDRs depicted in Table 1 and said variable heavy chain region comprising any two or three VH CDRs depicted in Table 1; or said variable light chain region comprising any two or three VL CDRs depicted in Table 2 and said variable heavy chain region comprising any two or three VH CDRs depicted in Table 2; or said variable light chain region comprising any two or three VL CDRs depicted in Table 3 and said variable heavy chain region comprising any two or three VH CDRs depicted in Table 3; or said variable light chain region comprising any two or three VL CDRs depicted in Table 4 and said variable heavy chain region comprising any two or three VH CDRs depicted in Table 4; or said variable light chain region comprising any two or three VL CDRs depicted in Table 5 and said variable heavy chain region comprising any two or three VH CDRs depicted in Table 5; or said variable light chain region comprising any two or three VL CDRs depicted in Table 6 and said variable heavy chain region comprising any two or three VH CDRs depicted in Table 6.

[0140] For example, an antibody or antigen-binding antibody fragment of the invention can comprise a VL1 domain comprising any of the VL1 CDRs depicted in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6; an antibody or antigen-binding antibody fragment of the invention can comprise a VL2 domain comprising any of the VL2 CDRs depicted in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6; or an antibody or antigen-binding antibody fragment of the invention can comprise a VL3 domain comprising any of the VL3 CDRs depicted in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6; an antibody or antigen-binding antibody fragment of the invention can comprise a VL1 domain and a VL2 domain comprising any of the VL1 CDRs and VL2 CDRs depicted in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6; an antibody or antigen-binding antibody fragment of the invention can comprise a VL1 domain and a VL3 domain comprising any of the VL1 CDRs and VL3 CDRs depicted in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6; an antibody or antigen-binding antibody fragment of the invention can comprise a VL2 domain and a VL3 domain comprising any of the VL2 CDRs and VL3 CDRs depicted in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6; and an antibody or antigen-binding antibody fragment of the invention can comprise a VL1 domain, a VL2 domain and a

VL3 domain comprising any of the VL1 CDRs, VL2 CDRs and VL3 CDRs depicted in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6.

**TABLE 1**  
CDR Sequences Of 117.1

CDR	Sequence	SEQ ID NO:
VH1	GFSLSTPGMGVG	3
VH2	HIWWDDFKRDNPAKLS	4
VH3	VDGNFLSWYFDV	5
VL1	RSSQSLVHSNGNTYLH	6
VL2	KVSNRFS	7
VL3	SQSRYPET	8

**TABLE 2**  
CDR Sequences Of 368.1

CDR	Sequence	SEQ ID NO:
VH1	GYSFTGFYMH	9
VH2	YVSCYTGATTYTQKFKG	10
VH3	EGDYYSMDF	11
VL1	RSSQSLERTNGNTYLH	12
VL2	KVSSRFS	13
VL3	SQTTHGPPT	14

TABLE 3  
CDR Sequences Of 501.1

CDR	Sequence	SEQ ID NO:
VH1	GYIFTDYGMN	15
VH2	CINTYTGETIYSDDFRG	16
VH3	GNYRDAIDY	17
VL1	KASQDIKSYLS	18
VL2	YATTLAD	19
VL3	LHHDESPFT	20

TABLE 4  
CDR Sequences Of 776.1

CDR	Sequence	SEQ ID NO:
VH1	GYTFTDYNIH	21
VH2	YIYPYNGVSDYNQNF	22
VH3	RWDFGSGYYFDY	23
VL1	RASSSVIYMC	24
VL2	GTSTLAS	25
VL3	QQWSSNPFT	26



**TABLE 5**  
**CDR Sequences Of 725.1**

CDR	Sequence	SEQ ID NO:
VH1	GYSFTNYGMN	60
VH2	WINAYIGEPTYADDFKG	61
VH3	GGNSLDF	62
VL1	RASSSVSSIH	63
VL2	ATSNLAS	64
VL3	QQWSIDPAT	65

**TABLE 6**  
**CDR Sequences Of 16H9**

CDR	Sequence	SEQ ID NO:
VH1	GFNIKDTYMH	66
VH2	RIDPANGNTKYDPKFQG	67
VH3	SDIYYGNPGGFAY	68
VL1	TASSSVSSSYLH	69
VL2	STSNLAS	70
VL3	HQYHRSPFT	71

[0141] The antibodies and antigen-binding antibody fragments of the invention are not, and generally do not compete with, OC125-like antibodies, M11-like antibodies or the OV 197 antibody, as defined in Nustad *et al.*, Tumor Biol. 17:196:219 (1996). In one embodiment, the antibodies and antigen-binding fragments of the invention are not, and

generally do not compete with, the OC 125-derived or VK-8-derived single chain antibodies described in WO 03/076465.

[0142] The antibodies of the invention can include, but are not limited to, polyclonal antibodies, monoclonal antibodies, chimeric antibodies, humanized antibodies, human antibodies, bi-specific antibodies, tri-specific antibodies, multi-specific antibodies, single-chain antibodies, disulfide-linked Fvs, single-chain Fvs, or anti-idiotypic antibodies. In a preferred embodiment, an antibody of the invention is a monoclonal antibody that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide. Multispecific antibodies may be specific for different epitopes of cell-associated CA 125/O772P or may be specific for both a cell-associated CA 125/O772P epitope as well as for a heterologous epitope, such as a heterologous polypeptide or solid support material. See, *e.g.*, Tutt *et al.*, J. Immunol. 147(1):60-69 (1991); Kostelny *et al.*, J. Immunol. 148(5):1547-1553 (1992); and U.S. Patent Nos. 4,474,893, 4,714,681, 4,925,648, 5,573,920, 5,601,819, 5,798,229, 5,855,866, 5,869,620, 5,897,861, 5,959,084, 6,106,833, 6,248,332, 6,258,358, 6,303,755, and 6,420,140.

[0143] The antigen-binding antibody fragments of the invention can include, but are not limited to, Fab fragments, F(ab')<sub>2</sub> fragments, variable light chain polypeptide (VL)-containing fragments, variable heavy chain polypeptide (VH)-containing fragments, or complementarity determining region (CDR)-containing fragments.

[0144] Further, the antibodies and antigen-binding antibody fragments of the invention can be of any immunoglobulin class. For example, the antibodies of the invention can be IgG, IgM, IgE, IgD, IgA or IgY class antibodies. The antibodies of the invention can also be of any isotype. For example, an antibody of the invention can be of an IgG<sub>1</sub>, IgG<sub>2</sub>, IgG<sub>3</sub>, IgG<sub>4</sub>, IgA<sub>1</sub> or IgA<sub>2</sub> heavy chain isotype. Preferably an antibody of the invention is of an IgG<sub>1</sub> isotype.

[0145] Still further, the antibodies or antigen-binding antibody fragments of the invention, can comprise one or more CDRs, *e.g.*, CDR sequences as described herein, inserted within naturally occurring or consensus framework regions, preferably human framework regions. Further, the antibodies or antigen-binding antibody fragments of the invention can comprise a variable light chain, for example, a  $\kappa$  or  $\lambda$  light chain variable region, and/or a variable heavy chain as described herein, inserted within naturally occurring or consensus framework regions, preferably human framework regions. Such framework regions are well known to those of skill in the art, *e.g.*, can comprise a C $\gamma$ 1 constant region or a C $\gamma$ 4 constant region.

[0146] The antibodies or antigen-binding antibody fragments that preferentially bind to cell-associated CA 125/O772P may be from any animal origin including birds, *e.g.*, chickens, and mammals, including non-primates (*e.g.*, a cow, pig, horse, donkey, goat, camel, cat, dog, guinea pig, rat, mouse, sheep) and primates (*e.g.*, a monkey, such as a cynomolgous monkey, gorilla, chimpanzee, and a human). Preferably, the antibodies and antigen-binding antibody fragments that preferentially bind to cell-associated CA 125/O772P are chimeric, human, or humanized antibodies, including monoclonal antibodies, or antigen-binding antibody fragments. As used herein, “human” antibodies or antigen-binding antibody fragments include antibodies or antigen-binding antibody fragments having the amino acid sequence of a human immunoglobulin, and include, for example, antibodies or antigen-binding antibody fragments isolated from human immunoglobulin libraries or from mice that express antibodies from human genes.

[0147] In another aspect, the present invention provides hybridoma cells that produce a monoclonal antibody of the invention. In one embodiment, a hybridoma of the present invention is hybridoma 4E7 (ATCC<sup>®</sup> Accession No. PTA-5109), hybridoma 7A11 (ATCC<sup>®</sup> Accession No. PTA-5110), hybridoma 7C6 (ATCC<sup>®</sup> Accession No. PTA-5111), hybridoma 7F10 (ATCC<sup>®</sup> Accession No. PTA-5112), hybridoma 7G10 (ATCC<sup>®</sup> Accession No. PTA-5245), hybridoma 7H1 (ATCC<sup>®</sup> Accession No. PTA-5114), hybridoma 8A1 (ATCC<sup>®</sup> Accession No. PTA-5115), hybridoma 8B5 (ATCC<sup>®</sup> Accession No. PTA-5116), hybridoma 8C3 (ATCC<sup>®</sup> Accession No. PTA-5246), hybridoma 8E3 (ATCC<sup>®</sup> Accession No. PTA-5118), hybridoma 8G9 (ATCC<sup>®</sup> Accession No. PTA-5119), hybridoma 15C9 (ATCC<sup>®</sup> Accession No. PTA-5106), hybridoma 16C7 (ATCC<sup>®</sup> Accession No. PTA-5107), hybridoma 16H9 (ATCC<sup>®</sup> Accession No. PTA-5108), hybridoma 117.1 (ATCC<sup>®</sup> Accession No. PTA-4567), hybridoma 325.1 (ATCC<sup>®</sup> Accession No. PTA-5120), hybridoma 368.1 (ATCC<sup>®</sup> Accession No. PTA-4568), hybridoma 446.1 (ATCC<sup>®</sup> Accession No. PTA-5549), hybridoma 501.1 (ATCC<sup>®</sup> Accession No. PTA-4569), hybridoma 621.1 (ATCC<sup>®</sup> Accession No. PTA-5121), hybridoma 633.1 (ATCC<sup>®</sup> Accession No. PTA-5122), hybridoma 654.1 (ATCC<sup>®</sup> Accession No. PTA-5247), hybridoma 725.1 (ATCC<sup>®</sup> Accession No. PTA-5124), or hybridoma 776.1 (ATCC<sup>®</sup> Accession No. PTA-4570).

[0148] In another embodiment, a hybridoma of the present invention is a hybridoma that produces monoclonal antibodies that compete with the monoclonal antibody produced by hybridoma 4E7 (ATCC<sup>®</sup> Accession No. PTA-5109), hybridoma 7A11 (ATCC<sup>®</sup> Accession No. PTA-5110), hybridoma 7C6 (ATCC<sup>®</sup> Accession No. PTA-5111), hybridoma 7F10 (ATCC<sup>®</sup> Accession No. PTA-5112), hybridoma 7G10 (ATCC<sup>®</sup> Accession No. PTA-5245),

hybridoma 7H1 (ATCC<sup>®</sup> Accession No. PTA-5114), hybridoma 8A1 (ATCC<sup>®</sup> Accession No. PTA-5115), hybridoma 8B5 (ATCC<sup>®</sup> Accession No. PTA-5116), hybridoma 8C3 (ATCC<sup>®</sup> Accession No. PTA-5246), hybridoma 8E3 (ATCC<sup>®</sup> Accession No. PTA-5118), hybridoma 8G9 (ATCC<sup>®</sup> Accession No. PTA-5119), hybridoma 15C9 (ATCC<sup>®</sup> Accession No. PTA-5106), hybridoma 16C7 (ATCC<sup>®</sup> Accession No. PTA-5107), hybridoma 16H9 (ATCC<sup>®</sup> Accession No. PTA-5108), hybridoma 117.1 (ATCC<sup>®</sup> Accession No. PTA-4567), hybridoma 325.1 (ATCC<sup>®</sup> Accession No. PTA-5120), hybridoma 368.1 (ATCC<sup>®</sup> Accession No. PTA-4568), hybridoma 446.1 (ATCC<sup>®</sup> Accession No. PTA-5549), hybridoma 501.1 (ATCC<sup>®</sup> Accession No. PTA-4569), hybridoma 621.1 (ATCC<sup>®</sup> Accession No. PTA-5121), hybridoma 633.1 (ATCC<sup>®</sup> Accession No. PTA-5122), hybridoma 654.1 (ATCC<sup>®</sup> Accession No. PTA-5247), hybridoma 725.1 (ATCC<sup>®</sup> Accession No. PTA-5124), or hybridoma 776.1 (ATCC<sup>®</sup> Accession No. PTA-4570) for binding to cell-associated CA 125/O772P.

## **5.2 Fusion Polypeptides of the Invention**

[0149] In another aspect, the present invention provides a fusion polypeptide comprising an antibody or an antigen-binding antibody fragment of the invention, that is, one that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide, operably linked to a heterologous agent. Fusion polypeptides of the invention also preferentially bind cell-associated CA 125/O772P. In one embodiment of a fusion polypeptide of the invention, the antibody, or antigen-binding antibody fragment, and the heterologous agent are operably linked via a covalent linkage, such as a peptide bond or disulfide linkage. In another embodiment of a fusion polypeptide of the invention, the antibody, or antigen-binding antibody fragment, and the heterologous agent are operably linked via non-covalent linkage. The heterologous agent can be linked to the amino terminus, carboxyl terminus, or at any point along the contiguous sequence of the antibodies or antigen-binding antibody fragments. The operable linkage need not be directly between the antibody or antigen-binding antibody fragment and the heterologous agent, but can, for example, occur through a linker or spacer agent or sequence.

[0150] In one embodiment of a fusion polypeptide of the invention, the heterologous agent comprises an amino acid sequence or a radioisotope. The heterologous agent of the fusion polypeptide of the invention can comprise a cytotoxic agent or a detectable agent.

[0151] Fusion polypeptides of the invention can, for example, be used in generating antibodies or antigen-binding antibody fragments of the invention. Alternatively, fusion

polypeptides can be utilized as part of the methods of prevention or treatment described herein. Still further fusion polypeptides of the invention can be utilized as part of *in vivo* and *in vitro* immunoassays and purification methods using methods known in the art. See *e.g.*, PCT publication Number WO 93/21232; U.S. Patent Nos. 5,314,995, 5,474,981, 5,514,558, 6,362,317, and 6,403,769; Nakamura *et al.*, Immunol. Lett. 39(1):91-99 (1993); Gillies *et al.*, Proc. Natl. Acad. Sci. USA. 89(4):1428-1432 (1992); and Fell *et al.*, J. Immunol. 146(7):2446-2452 (1991), which are incorporated herein by reference in their entireties.

[0152] In instances where the heterologous agent is a polypeptide, the heterologous polypeptide is generally at least about 5, at least about 10, at least about 20, at least about 30, at least about 40, at least about 50, at least about 60, at least about 70, at least about 80, at least about 90, or at least about 100 amino acids.

[0153] In one embodiment, the fusion polypeptides of the invention comprise antibodies or antigen-binding antibody fragments that preferentially bind cell-associated CA 125/O772P operably linked to a heterologous agent that provides a potential therapeutic benefit. For example, an antibody or an antigen-binding fragment thereof that preferentially binds cell-associated CA 125/O772P may be operably linked to a therapeutic moiety such as a cytotoxin, *e.g.*, a cytostatic or cytotoxic agent, an agent, or a radioactive ion, *e.g.*, alpha-emitters. See, *e.g.*, U.S. Patent Nos. 5,624,827, 5,643,573, 5,789,554, 5,824,782, 5,994,151, 6,042,829, 6,074,644, 6,099,842, 6,132,722, 6,187,287, 6,197,299, and 6,207,805. A cytotoxin or cytotoxic agent includes any agent that is detrimental to cell growth or cell viability. Examples of a cytotoxin or cytotoxic agent include, but are not limited to, paclitaxol, cytochalasin B, gramicidin D, ethidium bromide, emetine, mitomycin, etoposide, teniposide, vincristine, vinblastine, colchicin, doxorubicin, daunorubicin, dihydroxy anthracin dione, mitoxantrone, mithramycin, actinomycin D, 1-dehydrotestosterone, glucocorticoids, procaine, tetracaine, lidocaine, propranolol, and puromycin and analogs or homologs thereof. Other agents which have a potential therapeutic benefit include, but are not limited to, antimetabolites (*e.g.*, methotrexate, 6-mercaptopurine, 6-thioguanine, cytarabine, 5-fluorouracil decarbazine), alkylating agents (*e.g.*, mechlorethamine, thioepa chlorambucil, melphalan, carmustine (BSNU) and lomustine (CCNU), cyclophosphamide, busulfan, dibromomannitol, streptozotocin, mitomycin C, and cisdichlorodiamine platinum (II) (DDP) cisplatin), anthracyclines (*e.g.*, daunorubicin (formerly daunomycin) and doxorubicin), antibiotics (*e.g.*, dactinomycin (formerly actinomycin), bleomycin, mithramycin, and anthramycin (AMC)), maytansinoids and anti-mitotic agents (*e.g.*, vincristine and vinblastine) and radioactive material, including, but not limited to, bismuth

(<sup>213</sup>Bi), carbon (<sup>14</sup>C), chromium (<sup>51</sup>Cr), cobalt (<sup>57</sup>Co), fluorine (<sup>18</sup>F), gadolinium (<sup>153</sup>Gd, <sup>159</sup>Gd), gallium (<sup>68</sup>Ga, <sup>67</sup>Ga), germanium (<sup>68</sup>Ge), holmium (<sup>166</sup>Ho), indium (<sup>115</sup>In, <sup>113</sup>In, <sup>112</sup>In, <sup>111</sup>In), iodine (<sup>131</sup>I, <sup>125</sup>I, <sup>123</sup>I, <sup>121</sup>I), lanthanum (<sup>140</sup>La), lutetium (<sup>177</sup>Lu), manganese (<sup>54</sup>Mn), molybdenum (<sup>99</sup>Mo), palladium (<sup>103</sup>Pd), phosphorous (<sup>32</sup>P), praseodymium (<sup>142</sup>Pr), promethium (<sup>149</sup>Pm), rhenium (<sup>186</sup>Re, <sup>188</sup>Re), rhodium (<sup>105</sup>Rh), ruthenium (<sup>97</sup>Ru), samarium (<sup>153</sup>Sm), scandium (<sup>47</sup>Sc), selenium (<sup>75</sup>Se), strontium (<sup>85</sup>Sr), sulfur (<sup>35</sup>S), technetium (<sup>99</sup>Tc), thallium (<sup>201</sup>Tl), tin (<sup>113</sup>Sn, <sup>117</sup>Sn), tritium (<sup>3</sup>H), xenon (<sup>133</sup>Xe), ytterbium (<sup>169</sup>Yb, <sup>175</sup>Yb), yttrium (<sup>90</sup>Y), and zinc (<sup>65</sup>Zn).

[0154] Further, the antibody or antigen-binding antibody fragment can be conjugated to a therapeutic agent or drug moiety. Therapeutic agents or drug moieties are not to be construed as limited to classical chemical therapeutic agents. For example, the drug moiety may be a protein or polypeptide possessing a desired biological activity. Such proteins may include, for example, a toxin such as abrin, ricin A, pseudomonas exotoxin (*i.e.*, PE-40), or diphtheria toxin, ricin, gelonin, and pokeweed antiviral protein, a protein such as tumor necrosis factor, interferons including, but not limited to,  $\alpha$ -interferon (IFN- $\alpha$ ),  $\beta$ -interferon (IFN- $\beta$ ), nerve growth factor (NGF), platelet derived growth factor (PDGF), tissue plasminogen activator (TPA), an apoptotic agent (*e.g.*, TNF- $\alpha$ , TNF- $\beta$ , AIM I as disclosed in PCT Publication No. WO 97/33899), AIM II (see, PCT Publication No. WO 97/34911), Fas Ligand (Takahashi *et al.*, *J. Immunol.*, 6:1567-1574, 1994), and VEGI (PCT Publication No. WO 99/23105), a thrombotic agent or an anti-angiogenic agent (*e.g.*, antistatin or endostatin), or a biological response modifier such as, for example, a lymphokine (*e.g.*, interleukin-1 ("IL-1"), interleukin-2 ("IL-2"), interleukin-6 ("IL-6"), granulocyte macrophage colony stimulating factor ("GM-CSF"), and granulocyte colony stimulating factor (G-CSF)), macrophage colony stimulating factor ("M-CSF"), or a growth factor (*e.g.*, growth hormone ("GH")); proteases, or ribonucleases..

[0155] Fusion polypeptides of the invention can, alternatively, be used diagnostically to, *e.g.*, monitor the development or progression of cancer or tumor as part of a clinical testing procedure, for example to determine the efficacy of a given treatment regimen, such as where the antibody is coupled to a detectable agent. Examples of detectable agents include various enzymes, prosthetic groups, fluorescent materials, luminescent materials, bioluminescent materials, radioactive materials, positron emitting metals, and nonradioactive paramagnetic metal ions. The detectable agent may be coupled or conjugated either directly to the antibody or indirectly, through an intermediate (such as, for example, a linker known in

the art) using techniques known in the art. See, *e.g.*, U.S. Patent Nos. 4,741,900, 5,693,764, 5,776,095, 6,008,002, 6,013,531, 6,110,750, 6,124,105, 6,197,523, and 6,225,050.

[0156] Non-limiting examples of suitable enzymes that can be conjugated to an antibody or antigen-binding antibody fragment of the invention include  $\beta$ -lactamases,  $\beta$ -galactosidases, phosphatases, peroxidases, reductases, esterases, hydrolases, isomerases and proteases, such as horseradish peroxidase, alkaline phosphatase, beta-galactosidase, or acetylcholinesterase; non-limiting examples of suitable prosthetic group complexes include streptavidin/biotin and avidin/biotin. Non-limiting examples of suitable fluorescent materials include umbelliferone, fluorescein, fluorescein isothiocyanate, rhodamine, dichlorotriazinylamine fluorescein, green fluorescent protein, red fluorescent protein, dansyl chloride or phycoerythrin; a non-limiting example of a luminescent material includes luminol. Non-limiting examples of bioluminescent materials include luciferase, luciferin, and aequorin; and examples of suitable radioactive material include  $^{125}\text{I}$ ,  $^{131}\text{I}$ ,  $^{111}\text{In}$ ,  $^{99\text{m}}\text{Tc}$ , or  $^{90}\text{Y}$ .

[0157] The present invention also encompasses antibodies or antigen-binding fragments thereof that preferentially bind to cell-associated CA 125/O772P fused to marker sequences, such as a peptide to facilitate purification. For example, a marker amino acid sequence can be a hexa-histidine peptide, such as the tag provided in a pQE vector (QIAGEN, Inc., 9259 Eton Avenue, Chatsworth, CA, 91311), among others, many of which are commercially available. As described in Gentz *et al.*, Proc. Natl. Acad. Sci. USA. 86(3):821-824 (1989), for instance, histidine, *e.g.*, hexa-histidine, provides for convenient purification of the fusion protein. Other peptide tags useful for purification include, but are not limited to, the hemagglutinin "HA" tag, which corresponds to an epitope derived from the influenza hemagglutinin protein (Wilson *et al.*, Cell. 37(3):767-778 (1984)) and the "flag" tag (Brizzard *et al.*, Biotechniques. 16(4):730-735 (1994)). Preferably, such tags or marker sequences are cleaved from the fusion polypeptide prior to use, *e.g.*, use as part of a therapeutic method.

[0158] An antibody or an antigen-binding fragment thereof that preferentially binds cell-associated CA 125/O772P can also, for example, be operably linked to a second antibody to form an antibody heteroconjugate as described in U.S. Patent No. 4,676,980, which is incorporated herein by reference in its entirety.

[0159] Techniques for operably linking moieties to antibodies are well known, see, *e.g.*, Arnon *et al.*, "Monoclonal Antibodies For Immunotargeting Of Drugs In Cancer Therapy", in *Monoclonal Antibodies And Cancer Therapy*, Reisfeld *et al.*, eds., Alan R. Liss,

Inc. (1985) at pages 243-256; Hellstrom *et al.*, “Antibodies For Drug Delivery”, in *Controlled Drug Delivery (2nd Ed.)*, Robinson *et al.*, eds., Marcel Dekker, Inc. (1987) at pages 623-653; Thorpe, “Antibody Carriers Of Cytotoxic Agents In Cancer Therapy: A Review”, in *Monoclonal Antibodies '84: Biological And Clinical Applications*, Pinchera *et al.*, eds., Editrice Kurtis (1985) at pages 475-506; Order *et al.*, “Analysis, Results, And Future Prospective Of The Therapeutic Use Of Radiolabeled Antibody In Cancer Therapy”, in *Monoclonal Antibodies For Cancer Detection And Therapy*, Baldwin *et al.*, eds., Academic Press (1985) at pages 303-316; Thorpe *et al.*, *Immunol. Rev.* 62:119-158 (1982); and U.S. Patent Nos. 5,639,879, 5,744,119, 5,773,001, and 6,441,163.

[0160] Methods for fusing or conjugating polypeptides to the constant regions of antibodies are known in the art. See, *e.g.*, U.S. Patent Nos. 5,336,603, 5,622,929, 5,359,046, 5,349,053, 5,447,851, 5,648,218, 5,723,125, 5,783,181, 5,908,626, 5,844,095, 5,112,946, 6,030,613, 6,086,875, 6,194,177, 6,238,667, 6,262,026, and 6,277,375; EP 307,434; EP 367,166; EP 394,827; PCT publication WO 91/06570; Ashkenazi *et al.*, *Proc. Natl. Acad. Sci. USA.* 88(23):10535-10539 (1991); Traunecker *et al.*, *Nature.* 331(6151):84-86 (1988); Zheng *et al.*, *J. Immunol.* 154(10):5590-5600 (1995) and Vie *et al.*, *Proc. Natl. Acad. Sci. USA.* 89(23):11337-11341 (1992), which are incorporated herein by reference in their entireties.

### **5.3. Analogs of the Invention**

[0161] Also included among the antibodies, antigen-binding antibody fragments, and fusion polypeptides of the invention are antibody, antigen-binding antibody fragment, and fusion polypeptide analogs that preferentially bind cell-associated CA 125/O772P relative to shed CA 125/O772P. For example, among the analogs of the invention are analogs of the monoclonal antibody produced by hybridoma 4E7 (ATCC® Accession No. PTA-5109), hybridoma 7A11 (ATCC® Accession No. PTA-5110), hybridoma 7C6 (ATCC® Accession No. PTA-5111), hybridoma 7F10 (ATCC® Accession No. PTA-5112), hybridoma 7G10 (ATCC® Accession No. PTA-5245), hybridoma 7H1 (ATCC® Accession No. PTA-5114), hybridoma 8A1 (ATCC® Accession No. PTA-5115), hybridoma 8B5 (ATCC® Accession No. PTA-5116), hybridoma 8C3 (ATCC® Accession No. PTA-5246), hybridoma 8E3 (ATCC® Accession No. PTA-5118), hybridoma 8G9 (ATCC® Accession No. PTA-5119), hybridoma 15C9 (ATCC® Accession No. PTA-5106), hybridoma 16C7 (ATCC® Accession No. PTA-5107), hybridoma 16H9 (ATCC® Accession No. PTA-5108), hybridoma 117.1 (ATCC® Accession No. PTA-4567), hybridoma 325.1 (ATCC® Accession No. PTA-5120), hybridoma 368.1 (ATCC® Accession No. PTA-4568), hybridoma 446.1 (ATCC® Accession No. PTA-



5549), hybridoma 501.1 (ATCC<sup>®</sup> Accession No. PTA-4569), hybridoma 621.1 (ATCC<sup>®</sup> Accession No. PTA-5121), hybridoma 633.1 (ATCC<sup>®</sup> Accession No. PTA-5122), hybridoma 654.1 (ATCC<sup>®</sup> Accession No. PTA-5247), hybridoma 725.1 (ATCC<sup>®</sup> Accession No. PTA-5124), hybridoma 776.1 (ATCC<sup>®</sup> Accession No. PTA-4570), or analogs of antigen-binding antibody fragments thereof.

[0162] Such an analog possesses at least one of the following structural features: (a) an amino acid sequence that is preferably at least about 30%, at least about 35%, at least about 40%, at least about 45%, at least about 50%, at least about 55%, at least about 60%, at least about 65%, at least about 70%, at least about 75%, at least about 80%, at least about 85%, at least about 90%, at least about 95% or at least about 99% identical to the amino acid sequence of the pre-modified antibody, antigen-binding antibody fragment, or fusion polypeptide; (b) is encoded by a nucleotide sequence that hybridizes under stringent conditions to the complement of a nucleotide sequence encoding at least 5 contiguous amino acid residues, at least about 10 contiguous amino acid residues, at least about 15 contiguous amino acid residues, at least about 20 contiguous amino acid residues, at least about 25 contiguous amino acid residues, at least about 40 contiguous amino acid residues, at least about 50 contiguous amino acid residues, at least about 60 contiguous amino residues, at least about 70 contiguous amino acid residues, at least about 80 contiguous amino acid residues, at least about 90 contiguous amino acid residues, at least about 100 contiguous amino acid residues, at least about 110 contiguous amino acid residues, or at least about 120 contiguous amino acid residues of the amino acid sequence of the pre-modified antibody, antigen-binding antibody fragment, or fusion polypeptide; or (c) is encoded by a nucleotide sequence that is at least about 30%, at least about 35%, at least about 40%, at least about 45%, at least about 50%, at least about 55%, at least about 60%, at least about 65%, at least about 70%, at least about 75%, at least about 80%, at least about 85%, at least about 90%, at least about 95% or at least about 99% identical to the nucleotide sequence encoding the pre-modified antibody, antigen-binding antibody fragment, or fusion polypeptide.

[0163] In a specific embodiment, an analog of an antibody, antigen-binding antibody fragment, or fusion polypeptide that preferentially binds cell-associated CA 125/O772P comprises an amino acid sequence that is preferably at least about 35%, at least about 40%, at least about 45%, at least about 50%, at least about 55%, at least about 60%, at least about 65%, at least about 70%, at least about 75%, at least about 80%, at least about 85%, at least about 90%, at least about 95%, or at least about 99% identical to the amino acid sequence of the monoclonal antibody produced by hybridoma 4E7 (ATCC<sup>®</sup> Accession No. PTA-5109),

hybridoma 7A11 (ATCC<sup>®</sup> Accession No. PTA-5110), hybridoma 7C6 (ATCC<sup>®</sup> Accession No. PTA-5111), hybridoma 7F10 (ATCC<sup>®</sup> Accession No. PTA-5112), hybridoma 7G10 (ATCC<sup>®</sup> Accession No. PTA-5245), hybridoma 7H1 (ATCC<sup>®</sup> Accession No. PTA-5114), hybridoma 8A1 (ATCC<sup>®</sup> Accession No. PTA-5115), hybridoma 8B5 (ATCC<sup>®</sup> Accession No. PTA-5116), hybridoma 8C3 (ATCC<sup>®</sup> Accession No. PTA-5246), hybridoma 8E3 (ATCC<sup>®</sup> Accession No. PTA-5118), hybridoma 8G9 (ATCC<sup>®</sup> Accession No. PTA-5119), hybridoma 15C9 (ATCC<sup>®</sup> Accession No. PTA-5106), hybridoma 16C7 (ATCC<sup>®</sup> Accession No. PTA-5107), hybridoma 16H9 (ATCC<sup>®</sup> Accession No. PTA-5108), hybridoma 117.1 (ATCC<sup>®</sup> Accession No. PTA-4567), hybridoma 325.1 (ATCC<sup>®</sup> Accession No. PTA-5120), hybridoma 368.1 (ATCC<sup>®</sup> Accession No. PTA-4568), hybridoma 446.1 (ATCC<sup>®</sup> Accession No. PTA-5549), hybridoma 501.1 (ATCC<sup>®</sup> Accession No. PTA-4569), hybridoma 621.1 (ATCC<sup>®</sup> Accession No. PTA-5121), hybridoma 633.1 (ATCC<sup>®</sup> Accession No. PTA-5122), hybridoma 654.1 (ATCC<sup>®</sup> Accession No. PTA-5247), hybridoma 725.1 (ATCC<sup>®</sup> Accession No. PTA-5124), or hybridoma 776.1 (ATCC<sup>®</sup> Accession No. PTA-4570).

[0164] Preferably, the analogs include less than about 25, less than about 20, less than about 15, less than about 10, less than about 5, less than about 4, less than about 3, or less than about 2 amino acid substitutions, additions or deletions, or combinations thereof, relative to the original molecule. In a preferred embodiment, the analogs have conservative amino acid substitutions made at one or more amino acid residues predicted to be non-essential (*i.e.*, amino acid residues which are not critical for the antibody to specifically and preferentially bind to cell-associated CA 125/O772P). A “conservative amino acid substitution” is one in which the amino acid residue is replaced with an amino acid residue, mimic or analog having a side chain with a similar charge or polarity. Families of amino acid residues having side chains with similar charges have been defined in the art. These families include amino acids with basic side chains (*e.g.*, lysine, arginine, histidine), acidic side chains (*e.g.*, aspartic acid, glutamic acid), uncharged polar side chains (*e.g.*, glycine, asparagine, glutamine, serine, threonine, tyrosine, cysteine), nonpolar side chains (*e.g.*, alanine, valine, leucine, isoleucine, proline, phenylalanine, methionine, tryptophan), beta-branched side chains (*e.g.*, threonine, valine, isoleucine) and aromatic side chains (*e.g.*, tyrosine, phenylalanine, tryptophan, histidine).

[0165] Moreover, the analogs of the invention can include additions and/or be, at least in part, generated from deletions relative to the original molecule. Additions and/or deletions can be of any identity or combination so long as the structural criteria for analogs of the invention set forth above are satisfied.

[0166] To determine the percent identity of two amino acid sequences or of two nucleic acid sequences, the sequences are aligned for optimal comparison purposes (*e.g.*, gaps can be introduced in the sequence of a first amino acid or nucleic acid sequence for optimal alignment with a second amino acid or nucleic acid sequence). The amino acid residues or nucleotides at corresponding amino acid positions or nucleotide positions are then compared. When a position in the first sequence is occupied by the same amino acid residue or nucleotide as the corresponding position in the second sequence, then the molecules are identical at that position. The percent identity between the two sequences is a function of the number of identical positions shared by the sequences (*i.e.*, % identity = number of identical overlapping positions/total number of positions x 100%). In one embodiment, the two sequences are the same length.

[0167] The determination of percent identity between two sequences can also be accomplished using a mathematical algorithm. A preferred, non-limiting example of a mathematical algorithm utilized for the comparison of two sequences is the algorithm of Karlin *et al.*, Proc. Natl. Acad. Sci. USA. 87(6):2264-2268 (1990), as modified in Karlin *et al.*, Proc. Natl. Acad. Sci. USA. 90(12):5873-5877 (1993). Such an algorithm is incorporated into the BLASTN and BLASTX programs of Altschul *et al.*, J. Mol. Biol. 215(3):403-410 (1990). BLAST nucleotide searches can be performed with the BLASTN nucleotide program parameters set, *e.g.*, for score=100, wordlength=12 to obtain nucleotide sequences homologous to nucleic acid molecules of the present invention. BLAST protein searches can be performed with the BLASTX program parameters set, *e.g.*, to score=50, wordlength=3 to obtain amino acid sequences homologous to a protein molecule of the present invention. To obtain gapped alignments for comparison purposes, Gapped BLAST can be utilized as described in Altschul *et al.*, Nucleic Acids Res. 25(17):3389-3402 (1997). Alternatively, PSI-BLAST can be used to perform an iterated search which detects distant relationships between molecules (*Id.*). When utilizing BLAST, Gapped BLAST, and PSI-Blast programs, the default parameters of the respective programs (*e.g.*, of BLASTX and BLASTN) can be used. Another preferred, non-limiting example of a mathematical algorithm utilized for the comparison of sequences is the algorithm of Myers and Miller (Myers *et al.*, Comput. Appl. Biosci. 4(1):11-17 (1988)). Such an algorithm is incorporated in the ALIGN program (version 2.0), which is part of the GCG sequence alignment software package. When utilizing the ALIGN program for comparing amino acid sequences, a PAM120 weight residue table, a gap length penalty of 12, and a gap penalty of 4 can be used.

[0168] The percent identity between two sequences can be determined using techniques similar to those described above, with or without allowing gaps. In calculating percent identity, typically only exact matches are counted.

[0169] An analog can also refer to an antibody, antigen-binding antibody fragment or fusion polypeptide of the invention that has been modified by the attachment, *e.g.*, covalent attachment, of any type of molecule to a corresponding pre-modified antibody or antigen-binding antibody fragment, and which still preferentially binds cell-associated CA 125/O772P. For example, and not by way of limitation, an antibody, antigen-binding antibody fragment or fusion polypeptide can be modified by glycosylation, acetylation, alkylation, esterification, lipidation, formylation, pegylation, phosphorylation, amidation, derivatization by protecting/blocking groups, proteolytic cleavage, linkage to a cellular ligand or other protein, *etc.* Further, an analog can contain one or more non-classical amino acids. Non-classical amino acids include but are not limited to the D-isomers of the common amino acids,  $\alpha$ -amino isobutyric acid, 4-aminobutyric acid (4-Abu), 2-aminobutyric acid (2- Abu), 6-amino hexanoic acid (Ahx), 2-amino isobutyric acid (2-Aib), 3-amino propionic acid, ornithine, norleucine, norvaline, hydroxyproline, sarcosine, citrulline, cysteic acid, t-butylglycine, t-butylalanine, phenylglycine, cyclohexylalanine,  $\beta$ -alanine, fluoro-amino acids, designer amino acids such as  $\beta$ -methyl amino acids, C $\alpha$ -methyl amino acids, N $\alpha$ -methyl amino acids, and amino acid analogs in general.

[0170] In one embodiment, an analog of the invention exhibits increased affinity for cell-associated CA 125/O772P relative to that of a corresponding pre-modified antibody, antigen-binding antibody fragment or fusion polypeptide. In another specific embodiment, an antibody, antigen-binding antibody fragment or fusion polypeptide that preferentially binds cell-associated CA 125/O772P has an increased serum half-life relative to a corresponding pre-modified antibody, antigen-binding antibody fragment or fusion polypeptide. For example, an analog can exhibit a half-life in an animal, preferably a mammal and most preferably a human, of greater than about 1 day, greater than about 2 days, greater than about 3 days, greater than about 7 days, greater than about 10 days, preferably greater than about 15 days, greater than about 25 days, greater than about 30 days, greater than about 35 days, greater than about 40 days, or greater than about 45 days.

[0171] To prolong the serum circulation of antibodies, antigen-binding antibody fragments or fusion polypeptides *in vivo*, for example, inert polymer molecules such as high molecular weight polyethylene glycol (PEG) can be attached to the antibodies, antigen-binding antibody fragments or fusion polypeptides with or without a multifunctional linker

either through site-specific conjugation of the PEG to the amino- or carboxyl-terminus of the antibodies, antigen-binding antibody fragments or fusion polypeptides or via epsilon-amino groups present on lysine residues. Linear or branched polymer derivatization that results in minimal loss of biological activity is preferred. The degree of conjugation can be closely monitored by SDS-PAGE and mass spectrometry to ensure proper conjugation of PEG molecules to the antibodies. Unreacted PEG can be separated from antibody-, antigen-binding antibody fragment- or fusion polypeptide-PEG conjugates by size-exclusion or by ion-exchange chromatography. PEG-derivatized antibodies, antigen-binding antibody fragments and fusion polypeptides can be tested for binding activity as well as for *in vivo* efficacy using methods known to those of skill in the art, for example, by immunoassays described herein.

[0172] Antibodies or antigen-binding antibody fragments having an increased half-life *in vivo* can also be generated by introducing one or more amino acid modifications (*i.e.*, substitutions, insertions or deletions) into an IgG constant domain, or FcRn binding fragment thereof (preferably a Fc or hinge-Fc domain fragment). See, *e.g.*, PCT Publication No. WO 98/23289 and U.S. Patent No. 6,277,375, each of which is incorporated herein by reference in its entirety.

#### **5.4. Nucleic Acid Molecules of the Invention**

[0173] In yet another aspect, the present invention provides an isolated nucleic acid molecule that comprises a nucleotide sequence that encodes an antibody or antigen-binding antibody fragment, fusion polypeptide, or analog thereof, of the invention.

[0174] In one embodiment, a nucleic acid molecule of the invention encodes an antibody, antigen-binding antibody fragment, fusion polypeptide, or analog thereof, that comprises at least one, preferably two or three, of the light chain CDRs listed in Table 1, Table 2, Table 3, Table 4, Table 5 or Table 6. For example, a nucleic acid molecule of the invention can comprise a nucleotide sequence of SEQ ID NO:35, SEQ ID NO:37, SEQ ID NO:39, SEQ ID NO:41, SEQ ID NO:52, or SEQ ID NO:59 that encodes at least one, preferentially two or three, of said light chain CDRs.

[0175] In another embodiment, a nucleic acid molecule of the invention encodes an antibody, antigen-binding antibody fragment, fusion polypeptide, or analog thereof, that comprises at least one, preferably two or three, of the heavy chain CDRs listed in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6. For example, a nucleic acid molecule of the invention can comprise a nucleotide sequence of SEQ ID NO:36, SEQ ID NO:38, SEQ ID

NO:40, SEQ ID NO:42, SEQ ID NO:57 or SEQ ID NO:58 that encodes at least one, preferentially two or three of said heavy chain CDRs.

[0176] In another embodiment, a nucleic acid molecule of the invention comprises a nucleotide sequence that encodes an antibody, antigen-binding antibody fragment, fusion polypeptide or analog thereof that comprises a variable light chain polypeptide sequence shown in FIG. 5C, FIG. 6C, FIG. 7C, FIG. 8C, FIG. 9C or FIG. 10C. For example, a nucleic acid molecule of the invention can comprise the nucleotide sequence of SEQ ID NO:35 (117.1), SEQ ID NO:37 (368.1), SEQ ID NO:39 (501.1), SEQ ID NO:41 (776.1), SEQ ID NO:52 (725.1) or SEQ ID NO:59 (16H9).

[0177] In yet another embodiment, a nucleic acid molecule of the invention comprises a nucleotide sequence that encodes an antibody, antigen-binding antibody fragment, fusion polypeptide or analog thereof that comprises a variable heavy chain polypeptide sequence shown in FIG. 5D, FIG. 6D, FIG. 7D, FIG. 8D, FIG. 9D or FIG. 10D. For example, a nucleic acid molecule of the invention can comprise the nucleotide sequence of SEQ ID NO:36 (117.1), SEQ ID NO:38 (368.1), SEQ ID NO:40 (501.1), SEQ ID NO:42 (776.1), SEQ ID NO:57 (725.1) or SEQ ID NO:58 (16H9).

[0178] Among the nucleic acid molecules of the invention are nucleic acid molecules that are degenerate variants, or that hybridize under stringent conditions to the complement of a nucleic acid molecule having a nucleotide sequence encoding an antibody or antigen-binding antibody fragment of the invention. For example, in one embodiment, a nucleic acid molecule of the invention is one that hybridizes under stringent conditions to the complement of SEQ ID NO:35, SEQ ID NO:36, SEQ ID NO:37, SEQ ID NO:38, SEQ ID NO:39, SEQ ID NO:40, SEQ ID NO:41, SEQ ID NO:42, SEQ ID NO:52, SEQ ID NO:57, SEQ ID NO:58, or SEQ ID NO:59. Preferably, such hybridizing nucleic acid molecules of the invention encode an antibody or antigen-binding antibody fragment of the invention.

#### **5.5. Pharmaceutical Compositions of the Invention**

[0179] In another aspect, the present invention provides a pharmaceutical composition comprising an antibody or an antigen-binding antibody fragment, fusion polypeptide, analog or nucleic acid molecule of the invention, and a pharmaceutically acceptable carrier.

[0180] Preferably, a pharmaceutical composition of the invention comprises an antibody, antigen-binding antibody fragment, fusion polypeptide, or analog of the invention that exhibits a  $K_d$  of less than about 100 nM, less than about 10 nM, less than about 1 nM, less than about 100 pM, or less than about 10 pM for the peptide of Figure 1 (SEQ ID NO: 1) as measured by the BIAcore Affinity Assay, as described in Section 6.4. Alternatively, a

pharmaceutical composition of the invention can comprise an antibody, antigen-binding antibody fragment, fusion polypeptide, or analog or nucleic acid molecule of the invention that mediates lysis of a CA 125/O772P-positive tumor cell. Most preferably, a pharmaceutical composition of the invention comprises an antibody, antigen-binding antibody fragment, fusion polypeptide, analog or a nucleic acid molecule of the invention that encodes a polypeptide that inhibits CA 125/O772P-positive tumor growth, either by itself or when conjugated to a cytotoxic agent.

[0181] In one embodiment, the antibody or antigen-binding antibody fragment of the invention, or a fusion polypeptide or analog thereof, is conjugated to a cytotoxic agent useful in treating the cell-proliferative disease such as those cytotoxic agents recited in Section 5.2, hereinabove. In a particular embodiment, the cytotoxic agent is a radioisotope. In a further particular embodiment, the radioisotope is selected from the group consisting of  $^{125}\text{I}$ ,  $^{131}\text{I}$ ,  $^{111}\text{In}$ ,  $^{99\text{m}}\text{Tc}$  and  $^{90}\text{Y}$ .

[0182] The term “carrier” refers to a diluent, adjuvant (*e.g.*, Freund’s adjuvant (complete or incomplete)), excipient, stabilizing agent, preservatives, binder, or vehicle for administration of an antibody, antigen-binding antibody fragment, fusion polypeptide, or analog of the invention. Pharmaceutical carriers can be sterile liquids, such as water and oils, including those of petroleum, animal, vegetable or synthetic origin, such as peanut oil, soybean oil, mineral oil, sesame oil and the like. Water is a preferred carrier when the pharmaceutical composition is administered intravenously. Saline solutions and aqueous dextrose and glycerol solutions can also be employed as liquid carriers, particularly for injectable solutions. Suitable pharmaceutical excipients include starch, glucose, lactose, sucrose, gelatin, malt, rice, flour, chalk, silica gel, sodium stearate, glycerol monostearate, talc, sodium chloride, dried skim milk, glycerol, propylene, glycol, water, ethanol and the like. The composition, if desired, can also contain minor amounts of wetting or emulsifying agents, or pH buffering agents. These compositions can take the form of solutions, suspensions, emulsions, tablets, pills, capsules, powders, sustained-release formulations and the like. Oral formulation can include standard carriers such as pharmaceutical grades of mannitol, lactose, starch, magnesium stearate, sodium saccharine, cellulose, magnesium carbonate, etc. Examples of suitable pharmaceutical carriers are described in *Remington: The Science & Practice of Pharmacy*, 20<sup>th</sup> edition, Gennaro, ed., Lippincott (2000).

[0183] In a preferred embodiment, the pharmaceutical compositions are sterile and in suitable form for administration to a subject, preferably an animal subject, more preferably a mammalian subject, and most preferably a human subject.

[0184] In a specific embodiment, it may be desirable to administer the pharmaceutical compositions of the invention locally to the area in need of treatment. This may be achieved by, for example, and not by way of limitation, local infusion, by injection, or by means of an implant, said implant being of a porous, non-porous, or gelatinous material, including membranes, such as sialastic membranes, or fibers. Preferably, when administering pharmaceutical compositions, care must be taken to use materials to which the antibodies, antigen-binding antibody fragments, fusion polypeptides or analogs in the pharmaceutical composition or compositions do not adsorb.

[0185] In another embodiment, the pharmaceutical composition can be present and delivered in a vesicle, in particular a liposome (see, *e.g.*, Langer, *Science* 249(4976):1527-1533 (1990); Treat *et al.*, in *Liposomes in the Therapy of Infectious Disease and Cancer*, Lopez-Berestein *et al.*, eds., Liss (1989) at pages 353-365; Lopez-Berestein *et al.*, *ibid.*, at pages 317-327; Lopez-Berestein *et al.*, *ibid.*, generally; and U.S. Patent Nos. RE35,338, 5,662,931, 5,759,519, 5,879,713, 6,027,726, 6,099,857, 6,132,764, 6,245,427, 6,284,375, 6,350,466, and 6,417,326).

[0186] In yet another embodiment, the composition can be present and delivered in a controlled release or sustained release system. In one embodiment, a pump may be used to achieve controlled or sustained release (see, *e.g.*, Langer, *Science* 249(4976):1527-1533 (1990); Sefton, *Crit. Rev. Biomed. Eng.* 14(3):201-40 (1987); Buchwald *et al.*, *Surgery* 88(4):507-516 (1980); Saudek *et al.*, *N. Engl. J. Med.* 321(9):574-579 (1989); and U.S. Patent Nos. 5,720,720 and 6,352,683). In another embodiment, polymeric materials can be used to achieve controlled or sustained release of the antibodies, antigen-binding antibody fragments, fusion polypeptides or analogs of the invention or fragments thereof (see, *e.g.*, *Medical Applications of Controlled Release*, Langer and Wise (eds.), CRC Pres., Boca Raton, Florida (1974) *Medical Applications of Controlled Release*, Langer *et al.*, eds., CRC Press (1974); *Controlled Drug Bioavailability, Drug Product Design and Performance*, Smolen *et al.*, eds., Wiley (1984); Ranger *et al.*, *J. Macromol. Sci. Rev. Macromol. Chem.* 23:61 (1983); Levy *et al.*, *Science* 228(4696):190-192 (1985); During *et al.*, *Ann. Neurol.* 25(4):351-356 (1989); Howard *et al.*, *J. Neurosurg.* 71(1):105-112 (1989); U.S. Patent Nos. 5,128,326, 5,679,377, 5,863,985, 5,912,015, 5,916,597, 5,989,463, 5,994,492, 6,011,011, 6,020,004, 6,066,325, 6,180,608, 6,190,702, 6,214,966, 6,221,958, 6,221,977, 6,267,981, 6,362,276, 6,365,173, 6,375,985, 6,394,997, and 6,399,103; and PCT Publication No. WO 99/20253). Examples of polymers used in sustained release formulations include, but are not limited to, poly(2-hydroxy ethyl methacrylate), poly(methyl methacrylate), poly(acrylic acid),



poly(ethylene-co-vinyl acetate), poly(methacrylic acid), polyglycolides (PLG), polyanhydrides, poly(N-vinyl pyrrolidone), poly(vinyl alcohol), polyacrylamide, poly(ethylene glycol), polylactides (PLA), poly(lactide-co-glycolides) (PLGA), and polyorthoesters.

[0187] A pharmaceutical composition of the invention is formulated to be compatible with its intended route of administration. Examples of routes of administration include, but are not limited to, *e.g.*, parenteral (*e.g.*, intravenous, intradermal, intramuscular, subcutaneous), oral, intranasal, inhalation, transdermal (topical), transmucosal, and rectal administration. In a specific embodiment, the composition is formulated in accordance with routine procedures as a pharmaceutical composition adapted for intravenous, subcutaneous, intramuscular, oral, intranasal or topical administration to human beings. In a preferred embodiment, a pharmaceutical composition is formulated in accordance with routine procedures for subcutaneous administration to human beings. Typically, compositions for intravenous administration are solutions in sterile isotonic aqueous buffer. Where necessary, the composition may also include a solubilizing agent and a local anesthetic to ease pain at the site of the injection.

[0188] If the pharmaceutical compositions of the invention are to be administered topically, the compositions can be formulated in the form of, *e.g.*, an ointment, cream, transdermal patch, lotion, gel, shampoo, spray, aerosol, solution, emulsion, or other form well-known to one of skill in the art. See, *e.g.*, *Remington: The Science & Practice of Pharmacy*, 20<sup>th</sup> edition, Gennaro, ed., Lippincott (2000). For non-sprayable topical dosage forms, viscous to semi-solid or solid forms comprising a carrier or one or more excipients compatible with topical application and having a dynamic viscosity preferably greater than water are typically employed. Suitable formulations include, without limitation, solutions, suspensions, emulsions, creams, ointments, powders, liniments, salves, and the like, which can be, if desired, sterilized or mixed with auxiliary agents (*e.g.*, preservatives, stabilizers, wetting agents, buffers, or salts) for influencing various properties, such as, for example, osmotic pressure. Other suitable topical dosage forms include sprayable aerosol preparations wherein the active ingredient, preferably in combination with a solid or liquid inert carrier, is packaged in a mixture with a pressurized volatile (*e.g.*, a gaseous propellant, such as freon), or in a squeeze bottle. Moisturizers or humectants can also be added to pharmaceutical compositions and dosage forms if desired. Examples of such additional ingredients are well-known in the art.

[0189] If the pharmaceutical compositions of the invention are to be administered intranasally, the compositions can be formulated in an aerosol form, spray, mist or in the form of drops. In particular, agents for use according to the present invention can be conveniently delivered in the form of an aerosol spray presentation from pressurized packs or a nebuliser, with the use of a suitable propellant, *e.g.*, dichlorodifluoromethane, trichlorofluoromethane, dichlorotetrafluoroethane, carbon dioxide or other suitable gas. In the case of a pressurized aerosol the dosage unit may be determined by providing a valve to deliver a metered amount. Capsules and cartridges of, *e.g.*, gelatin for use in an inhaler or insufflator may be formulated containing a powder mix of the compound and a suitable powder base such as lactose or starch.

[0190] If the pharmaceutical compositions of the invention are to be administered orally, the pharmaceutical compositions can be formulated orally in the form of, *e.g.*, tablets, capsules, cachets, gelcaps, solutions, suspensions and the like. Tablets or capsules can be prepared by conventional means with pharmaceutically acceptable excipients such as binding agents (*e.g.*, pregelatinised maize starch, polyvinylpyrrolidone or hydroxypropyl methylcellulose); fillers (*e.g.*, lactose, microcrystalline cellulose or calcium hydrogen phosphate); lubricants (*e.g.*, magnesium stearate, talc or silica); disintegrants (*e.g.*, potato starch or sodium starch glycolate); or wetting agents (*e.g.*, sodium lauryl sulphate). The tablets may be coated by methods well-known in the art. Liquid preparations for oral administration may take the form of, for example, solutions, syrups or suspensions, or they may be presented as a dry product for constitution with water or other suitable vehicle before use. Such liquid preparations may be prepared by conventional means with pharmaceutically acceptable additives such as suspending agents (*e.g.*, sorbitol syrup, cellulose derivatives or hydrogenated edible fats); emulsifying agents (*e.g.*, lecithin or acacia); non-aqueous vehicles (*e.g.*, almond oil, oily esters, ethyl alcohol or fractionated vegetable oils); and preservatives (*e.g.*, methyl or propyl-*p*-hydroxybenzoates or sorbic acid). The preparations may also contain buffer salts, flavoring, coloring and sweetening agents as appropriate. Preparations for oral administration may be suitably formulated for slow release, controlled release or sustained release of a prophylactic or therapeutic agent(s).

[0191] The pharmaceutical compositions of the invention may be formulated for parenteral administration by injection, *e.g.*, by bolus injection or continuous infusion. Formulations for injection may be presented in unit dosage form, *e.g.*, in ampoules or in multi-dose containers, with an added preservative. The pharmaceutical compositions may take such forms as suspensions, solutions or emulsions in oily or aqueous vehicles, and may

contain formulatory agents such as suspending, stabilizing and/or dispersing agents.

Alternatively, the active ingredient may be in powder form for constitution with a suitable vehicle, e.g., sterile pyrogen-free water, before use.

[0192] The pharmaceutical compositions of the invention may also be formulated in rectal compositions such as suppositories or retention enemas, e.g., containing conventional suppository bases such as cocoa butter or other glycerides.

[0193] In addition to the formulations described previously, the compositions of the invention may also be formulated as a depot preparation. Such long acting formulations may be administered by implantation (for example, subcutaneously or intramuscularly) or by intramuscular injection. Thus, for example, the pharmaceutical compositions may be formulated with suitable polymeric or hydrophobic materials (for example as an emulsion in an acceptable oil) or ion exchange resins, or as sparingly soluble derivatives, for example, as a sparingly soluble salt.

[0194] Generally, the ingredients of pharmaceutical compositions of the invention are supplied either separately or mixed together in unit dosage form, for example, as a dry lyophilized powder or water free concentrate in a hermetically sealed container such as an ampoule or sachette indicating the quantity of active agent. Where the pharmaceutical composition is to be administered by infusion, it can be dispensed with an infusion bottle containing sterile pharmaceutical grade water or saline. Where the pharmaceutical composition is administered by injection, an ampoule of sterile water for injection or saline can be provided so that the ingredients may be mixed prior to administration.

[0195] For antibodies, antigen-binding antibody fragments, fusion polypeptides, and analogs of the invention, the dosage administered to a subject is generally from about 5  $\mu\text{g/kg}$  to about 10 mg/kg, more preferably from about 20  $\mu\text{g/kg}$  to about 5 mg/kg of the subject's body weight, most preferably from about 100  $\mu\text{g/kg}$  to about 5mg/kg. The dosage can be administered up to about 6 treatments over a period of weeks to months, as determined by the administering physician. Generally, human antibodies have a longer half-life within the human body than antibodies from other species due to the immune response to the foreign polypeptides. Thus, lower dosages and less frequent administration of human antibodies are often possible. Further, the dosage and frequency of administration of antibodies of the invention or fragments thereof may be reduced by enhancing uptake and tissue penetration of the antibodies by modifications such as, for example, lipidation.

[0196] The precise dose to be employed in the formulation will also depend on the route of administration, and the seriousness of the condition, and should be decided according

to the judgment of the practitioner and each patient's circumstances in view of published clinical studies. Effective doses may be extrapolated from dose-response curves derived from in vitro or animal model test systems.

[0197] In one embodiment, a pharmaceutical composition of the invention is packaged in a hermetically sealed container such as an ampoule or sachette indicating the quantity of the antibody, antigen-binding antibody fragment, fusion polypeptide or analog. In another embodiment, a pharmaceutical composition of the invention is supplied as a dry sterilized lyophilized powder or water free concentrate in a hermetically sealed container and can be reconstituted, *e.g.*, with water or saline to the appropriate concentration for administration to a subject. In yet another embodiment, a pharmaceutical composition is suspended in liquid form in a hermetically sealed container indicating the quantity and concentration of the antibody, antigen-binding antibody fragment, fusion polypeptide or analog.

[0198] In yet another embodiment, a pharmaceutical composition of the invention is supplied in a hermetically sealed container at a unit dosage of at least about 5 mg, more preferably at least about 1 mg, more preferably at least about 2 mg, 5 mg, 10 mg, 15 mg, 25 mg, 35 mg, 45 mg, 50 mg, 75 mg, 100 mg, 200 mg, 300 mg, 400 mg, or 500 mg. When supplied in liquid form, the pharmaceutical composition may be supplied in such a sealed container in a concentration of at least 1 mg/ml.

[0199] The present invention also provides a method of preparing a pharmaceutical composition of the invention, comprising admixing an antibody, antigen-binding antibody fragment, fusion polypeptide or analog of the invention with a pharmaceutically acceptable carrier.

#### **5.6. Articles of Manufacture of the Invention**

[0200] In still another aspect, the present invention provides an article of manufacture comprising packaging material and a pharmaceutical composition of the invention contained within the packaging material, said pharmaceutical composition in a form suitable for administration to a subject, preferably a human, or in a format that can be diluted or reconstituted for administration to the subject. In one embodiment, the article of manufacture further comprises printed instructions and/or a label directing the use or administration of the pharmaceutical composition. The instructions and/or label can, for example, suggest a dosing regimen for the prevention or treatment of one or more symptoms of a CA 125/O772P-related disorder, such as a cell proliferative disorder, for example cancer, *e.g.*, ovarian, uterine, breast, or lung cancer. Thus, instructions and/or label can provide informational material that advises the physician, technician or subject on how to appropriately prevent, manage, treat or

ameliorate a CA 125/O772P-related disorder or one or more symptoms of said disorder, for example, a cell proliferative disorder, such as cancer, *e.g.*, ovarian cancer.

[0201] As with any pharmaceutical product, the packaging material and container of the articles of manufacture of the invention are designed to protect the stability of the product during storage and shipment. More specifically, the invention provides an article of manufacture comprising packaging material, such as a box, bottle, tube, vial, container, sprayer, insufflator, intravenous (i.v.) bag, envelope and the like; and at least one unit dosage form of a pharmaceutical composition of the invention contained within said packaging material.

**5.7. Methods of Identifying Antibodies and Antigen-Binding Antibody Fragments that Preferentially Bind Cell-Associated CA 125/O772P**

[0202] The present invention provides a method to assist in identifying an antibody or antigen-binding antibody fragment that preferentially binds cell-associated CA 125/O772P relative to shed CA 125/O772P. In one embodiment, a method for identifying an antibody or antigen-binding antibody fragment that preferentially binds cell-associated CA 125/O772P comprises contacting an antibody or antigen-binding antibody fragment with a peptide comprising cell-associated CA 125/O772P in the presence of shed CA 125/O772P under conditions that allow binding of the antibody or antigen-binding antibody fragment to either said peptide comprising cell-associated CA 125/O772P or shed CA 125/O772P. After incubating, the shed CA 125/O772P (with or without antibody or antigen-binding antibody fragment bound) and unbound antibody or antigen-binding antibody fragment are removed, and the amount of antibody or antigen-binding antibody fragment bound to the peptide comprising cell-associated CA 125/O772P is measured. If the antibody or antigen-binding antibody fragment of the method satisfies any one of the three embodiments set forth above for “preferential binding,” then said antibody or antigen-binding antibody fragment is one that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide. In a preferred embodiment, the ratio of shed CA 125/O772P to cell-associated CA 125/O772P to cell-associated CA 125/O772P in the reaction mixture is about 25:1 (wt/wt.). As part of this method, cell-associated CA 125/O772P can be immobilized on a solid surface. For example, the method can be performed in an ELISA format.

[0203] In another embodiment, the invention provides a method to assist in identifying an antibody, or antigen-binding antibody fragment, that preferentially binds cell-associated CA 125/O772P comprises contacting an antibody, or antigen-binding fragment, with a peptide comprising cell-associated CA 125/O772P and shed CA 125/O772P (*e.g.*, about a 25-

fold (weight/weight) excess amount), under conditions that allow binding of the peptide comprising cell-associated CA 125/O772P to the antibody or antigen-binding antibody fragment, removing unbound peptide comprising cell-associated CA 125/O772P, measuring the amount of peptide comprising cell-associated CA 125/O772P bound by the antibody, or antigen-binding fragment, and comparing the amount measured to the amount of peptide comprising cell-associated CA 125/O772P the antibody or antigen-binding antibody fragment can bind in the absence of such amount of shed CA 125/O772P. If the antibody or antigen-binding antibody fragment of the method satisfies any one of the three embodiments set forth above for “preferentially binds,” then said antibody or antigen-binding antibody fragment is one that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide. As part of this method the antibody, or antigen-binding antibody fragment can be immobilized on a solid surface, for example, the method can be performed in an ELISA format. The teaching provided herein, coupled with standard techniques well-known to those of skill in the art, can be utilized in practicing such methods for identification of antibodies, or antigen-binding antibody fragments, of the invention. For example, among the assays that can be utilized in identifying such antibodies or antigen-binding antibody fragments is the ELISA Competition Assay described in Section 6 and its subsections, below.

[0204] In yet another embodiment, the invention provides a method to assist in identifying an antibody, or antigen-binding antibody fragment, that preferentially binds cell-associated CA 125/O772P comprises contacting an antibody, or antigen-binding fragment, with a cell that expresses CA 125/O772P and with an amount, *e.g.*, at least about 0.05 mg/ml, of shed CA 125/O772P under conditions that allow binding of the CA 125/O772P to the antibody or antigen-binding antibody fragment, removing unbound cells, measuring the amount of cells expressing CA 125/O772P bound by the antibody, or antigen-binding fragment, and comparing the amount measured to the amount of cells expressing CA 125/O772P that binds the antibody or antigen-binding antibody fragment in the absence of such an amount of shed CA 125/O772P. If the antibody or antigen-binding antibody fragment of the method satisfies any one of the three embodiments set forth above for “preferentially binds,” then said antibody or antigen-binding antibody fragment is one that preferentially binds cell-associated CA 125/O772P polypeptide relative to shed CA 125/O772P polypeptide. Such a method can, for example, be performed wherein the measuring is performed by flow cytometry techniques, including, *e.g.*, fluorescence activated cell sorting. The teaching provided herein, coupled with standard techniques well known to those of skill in the art, can be utilized in practicing such methods for identification of

antibodies, or antigen-binding antibody fragments, of the invention. For example, among the assays that can be utilized in identifying such antibodies or antigen-binding antibody fragments are the Flow Cytometry Competition Assay in Section 6 and its subsections, below.

[0205] Among the embodiments of the present invention are antibodies and antigen-binding antibody fragments that preferentially bind cell-associated CA 125/O772P and that are specific for CA 125/O772P. Antibodies that are specific for CA 125/O772P can routinely be identified by, for example, utilizing the ELISA Specificity Assay and the Flow Cytometry Specificity Assay described, below, in Section 6 and its subsections. As such, the present invention also provides methods for identifying antibodies and antigen-binding antibody fragments that are specific for CA 125/O772P and which also preferentially bind cell-associated CA 125/O772P. In one such embodiment, first, an antibody or antigen-binding antibody fragment that is specific for CA 125/O772P is identified, *e.g.*, by utilizing a ELISA Specificity Assay and/or a Flow Cytometry Specificity Assay. The antibody or antigen-binding antibody fragment is then tested for an ability to preferentially bind cell-associated CA 125/O772P utilizing, *e.g.*, one of the methods described herein.

[0206] Also among the embodiments of the present invention are antibodies and antigen-binding antibody fragments that preferentially bind cell-associated CA 125/O772P and that bind the peptide of Figure 1 (SEQ ID NO: 1) with a  $K_d$  of less than about 100 nM, less than about 10 nM, less than about 1 nM, less than about 100 pM, or less than about 10 pM as measured by the BIAcore Affinity Assay, which is described in Section 6.4. Such antibodies can routinely be identified by, for example, adopting the ELISA Affinity Assay described below in Section 6 and its subsections. As such, the present invention also provides methods for identifying antibodies and antigen-binding antibody fragments that preferentially bind cell-associated CA 125/O772P and also bind cell-associated CA 125/O772P with at least a certain minimum level of affinity. In one such embodiment, first, an antibody or antigen-binding antibody fragment is identified that preferentially binds cell-associated CA 125/O772P utilizing, *e.g.*, one of the methods described herein. The antibody or antigen-binding antibody fragment is then tested for an ability to bind cell-associated CA 125/O772P (or a peptide comprising the same) with a  $K_d$  of less than about 100 nM, less than about 10 nM, less than about 1 nM, less than about 100 pM, or less than about 10 pM, utilizing, for example, one of the techniques described herein.

[0207] Embodiments of the present invention also include antibodies and antigen-binding antibody fragments that preferentially bind cell-associated CA 125/O772P and that

exhibit an ability to mediate lysis of CA 125/O772P-positive cells, *e.g.*, tumor cells. Such antibodies and antigen-binding antibody fragments can routinely be identified by, for example, performing the ADCC and/or CDC assays described below in Section 6 and its subsections. As such, the present invention provides methods for identifying antibodies or antigen-binding antibody fragments that preferentially bind cell-associated CA 125/O772P and which also exhibit an ability to mediate lysis of CA 125/O772P-positive cells. In one such embodiment, an antibody or antigen-binding antibody fragment is identified that preferentially binds cell-associated CA 125/O772P utilizing, *e.g.*, one of the methods presented herein. The antibody or antigen-binding antibody fragment is then tested for an ability to mediate lysis of CA 125/O772P-positive cells via, for example, an ADCC and/or CDC assay as described herein.

[0208] Embodiments of the present invention also include antibodies and antigen-binding antibody fragments that preferentially bind CA 125/O772P and that exhibit an ability to inhibit or slow growth of CA 125/O772P-positive tumors. Such antibodies can routinely be identified by, for example, performing *in vivo* assays previously described, such as those found in Treskes *et al.*, Eur. J. Cancer. 30A(2):183-187 (1994); Ahmad *et al.*, Oncol. Res. 11(6):273-280 (1999); and Kievit *et al.*, Int. J. Radiat. Onc. Biol. Phys. 38(2):419-428 (1997), each of which is incorporated herein by reference in its entirety. As such, the present invention also provides methods for identifying antibodies or antigen-binding antibody fragments that preferentially bind CA 125/O772P and which also exhibit an ability to inhibit growth of CA 125/O772P-positive tumor cells. In one such embodiment, an antibody or antigen-binding antibody fragment is identified that preferentially binds cell-associated CA 125/O772P utilizing, *e.g.*, one of the methods presented herein. The antibody or antigen-binding antibody fragment is then tested for an ability to inhibit growth of CA 125/O772P-positive tumor cells via, for example, testing the antibody or antigen-binding antibody fragment in a system such as one of the *in vivo* systems described in the citations above.

#### **5.8. Methods of Preventing, Treating, Managing, or Ameliorating a Symptom of a CA 125/O772P-Related Disorder**

[0209] The present invention provides methods for prevention, treatment, or management of a CA 125/O772P-related disorder, or amelioration of a symptom of a CA 125/O772P-related disorder. For example, the present invention provides methods for the prevention, treatment, management, or amelioration of a symptom of a cell proliferative disorder, by administering to a subject in need of such prevention, treatment, management, or



amelioration an amount of an antibody, antigen-binding antibody fragment, or analog effective to effectuate the desired outcome in the subject.

[0210] As discussed throughout, the antibodies and antigen-binding antibody fragments of the invention are those that preferentially bind cell-associated CA 125/O772P. Likewise the fusion polypeptides and analogs of the invention also preferentially bind cell-associated CA 125/O772P. As also noted herein, due to the fact that cell-associated CA 125/O772P, prior to CA 125/O772P shedding, is present or part of CA 125/O772P, it is noted that antibodies, antigen-binding antibody fragments, fusion polypeptides, and analogs of the invention can also bind CA 125/O772P. Thus, while not wishing to be bound by any particular mechanism or theory thereof, it is noted that the methods described in this section can be effectuated, at least in part, by binding of the administered antibody, antigen-binding antibody fragments, fusion polypeptides, or analogs for the invention to pre-shed CA 125/O772P in addition to, or instead of, their binding to post-shed cell-associated CA 125/O772P.

[0211] In one embodiment, the methods of the invention relate to prevention, treatment, management, or amelioration of a symptom of a cancer. For example, these methods of the invention relate to prevention, treatment, management, or amelioration of a symptom of cancers or cancer-associated disorders, said cancers including but not limited to such cancers as carcinomas, sarcomas, myelomas, leukemias, lymphomas and mixed type cancers. In a particular embodiment, such methods of the invention relate to prevention, treatment, management, or amelioration of ovarian cancer, cervical cancer, uterine cancer, breast cancer or lung cancer, or a symptom thereof. In a preferred embodiment of such methods of the invention, such methods relate to prevention, treatment, management, or amelioration of a symptom of ovarian cancer.

[0212] In another embodiment, the present invention provides a method for treating a CA 125/O772P-related disorder, or ameliorating a symptom thereof, comprising administering to a subject in need of such treatment or amelioration, an antibody, antigen-binding fragment of an antibody, fusion polypeptide or analog of the invention in an amount sufficient to treat the cell proliferative disorder or ameliorate a symptom thereof. The CA 125/O772P-related disorder can, for example, be a cell proliferative disorder such as cancer and can include, *e.g.*, ovarian, cervical cancer, uterine cancer, breast cancer or lung cancer. Such an embodiment is preferably practiced where the antibody, antigen-binding antibody fragment, fusion polypeptide or analog of the invention is conjugated to a cytotoxic agent useful in treating the cell-proliferative disease such as those agents recited in Section 5.2. In

a particular embodiment, the cytotoxic agent is a radioisotope. In a further particular embodiment, the radioisotope is selected from the group consisting of  $^{125}\text{I}$ ,  $^{131}\text{I}$ ,  $^{111}\text{In}$ ,  $^{99\text{m}}\text{Tc}$  and  $^{90}\text{Y}$ . Such an embodiment can be practiced as part of a combination cancer therapy, by, for example, further administering a chemotherapeutic agent, such as paclitaxel or cisplatin, or radiation treatment to the subject.

[0213] In yet another embodiment, the present invention provides a method for preventing a CA 125/O772P-related disorder or a symptom of a CA 125/O772P-related disorder, comprising administering to a subject in need of such prevention, an antibody, antigen-binding fragment of an antibody, fusion polypeptide or analog of the invention in an amount sufficient to prevent the CA 125/O772P-related disorder, or a symptom thereof. The CA 125/O772P-related disorder can, for example, be a cell proliferative disorder such as cancer and can include, *e.g.*, ovarian, cervical cancer, uterine cancer, breast cancer or lung cancer.

[0214] In additional embodiments, the CA 125/O772P-related disorder is a bone cancer, for example, Ewing's sarcoma, osteosarcoma, rhabdomyosarcoma, or another soft-tissue sarcoma. In another embodiment, the CA 125/O772P-related disorder is a brain tumor, for example, oligodendroglioma, ependymoma, meningioma, lymphoma, schwannoma, or medulloblastoma. In another embodiment, the CA 125/O772P-related disorder is a breast cancer, for example, ductal carcinoma *in situ* of the breast. In another embodiment, the CA 125/O772P-related disorder is an endocrine system cancer, for example, adrenal, pancreatic, parathyroid, pituitary, or thyroid cancers. In another embodiment, the CA 125/O772P-related disorder is a gastrointestinal cancer, for example, anal, colorectal, esophageal, gallbladder, gastric, liver, pancreatic, or small intestine cancer. In another embodiment, the CA 125/O772P-related disorder is a gynecological cancer, for example, cervical, endometrial, uterine, fallopian tube, gestational trophoblastic disease, choriocarcinoma, ovarian, vaginal, or vulvar cancer. In another embodiment, the CA 125/O772P-related disorder is a head and neck cancer, for example, laryngeal, oropharyngeal, parathyroid or thyroid cancer. In another embodiment, the CA 125/O772P-related disorder is a leukemic cancer, for example, acute lymphocytic leukemia, acute myelogenous leukemia, chronic lymphocytic leukemia, chronic myelogenous leukemia, hairy cell leukemia, or a myeloproliferative disorder. In another embodiment, the CA 125/O772P-related disorder is a lung cancer, for example, a mesothelioma, a non-small cell lung cancer, or a small cell lung cancer. In another embodiment, the CA 125/O772P-related disorder is a lymphoma, for example, AIDS-related lymphoma, cutaneous T cell lymphoma, Hodgkin's

disease, or non-Hodgkin's disease. In another embodiment, the CA 125/O772P-related disorder is metastatic cancer. In another embodiment, the CA 125/O772P-related disorder is a myeloma, for example, a multiple myeloma. In another embodiment, the CA 125/O772P-related disorder is a pediatric cancer, for example, a brain tumor, Ewing's sarcoma, leukemia (*e.g.*, acute lymphocytic leukemia or acute myelogenous leukemia), liver cancer, a lymphoma (*e.g.*, Hodgkin's lymphoma or non-Hodgkin's lymphoma), neuroblastoma, retinoblastoma, a sarcoma (*e.g.*, osteosarcoma, rhabdomyosarcoma or other soft-tissue sarcomas), or Wilms' Tumor. In another embodiment, the CA 125/O772P-related disorder is penile cancer. In another embodiment, the CA 125/O772P-related disorder is prostate cancer. In another embodiment, the CA 125/O772P-related disorder is a skin cancer, for example, cutaneous T cell lymphoma, mycosis fungoides, Kaposi's sarcoma, or melanoma. In another embodiment, the CA 125/O772P-related disorder is testicular cancer. In another embodiment, the CA 125/O772P-related disorder is a thyroid cancer, for example, papillary, follicular, medullary, anaplastic, or undifferentiated thyroid carcinoma. In another embodiment, the CA 125/O772P-related disorder is a urinary tract cancer, for example, bladder, kidney, or urethral cancer. In another embodiment, the CA 125/O772P-related disorder or cancer-related condition is ataxia-telangiectasia, carcinoma of unknown primary origin, Li-Fraumeni syndrome, or thymoma.

[0215] In one embodiment of such methods of the invention, an antibody or antigen-binding fragment of the invention is administered. In another embodiment, a monoclonal antibody or antigen-binding monoclonal antibody fragment is administered. Typically, the antibody or antigen-binding antibody fragment is administered at a dosage concentration of about 5 $\mu$ g/kg to about 10mg/kg, more preferably from about 20 $\mu$ g/kg to about 5mg/kg, and most preferably from about 100 $\mu$ g/kg to about 5mg/kg of the subject's body weight.

[0216] In general, the methods described herein can be utilized via administration of a pharmaceutical composition of the invention. The toxicity and/or efficacy of the compositions administered according to the particular protocols practiced as part of the instant invention can be determined by standard pharmaceutical procedures in cell cultures or experimental animals, *e.g.*, for determining the LD<sub>50</sub> (the dose lethal to 50% of the population) and the ED<sub>50</sub> (the dose therapeutically effective in 50% of the population). The dose ratio between toxic and therapeutic effects is the therapeutic index and it can be expressed as the ratio LD<sub>50</sub>/ED<sub>50</sub>. Compositions that exhibit large therapeutic indices are preferred. While compositions that exhibit toxic side effects may be used, it is preferable that

a delivery system be utilized that targets such compositions to the site of affected tissue, *e.g.*, ovarian tissue, thereby reducing side effects.

[0217] Data obtained from the cell culture assays and animal studies can be used in formulating a range of dosage of compositions for use in humans. The dosage of such compositions lies preferably within a range that results in circulating concentrations that include the ED<sub>50</sub> with little or no toxicity. The dosage may vary within this range depending upon the dosage form employed and the route of administration utilized. For any agent used in the methods of the invention, the therapeutically effective dose can be estimated initially from cell culture assays. A dose may be formulated in animal models to achieve a circulating plasma concentration range that includes the IC<sub>50</sub> (*i.e.*, the concentration of the compound that achieves a half-maximal inhibition of one or more symptoms) as determined in cell culture assays, *e.g.*, proliferation assays. Such information can be used to more accurately determine useful doses in humans. Levels in plasma may be measured, for example, by high performance liquid chromatography.

[0218] Various delivery systems are known and can be used to administer an antibody, antigen-binding antibody fragment, fusion polypeptide or analog of the invention, *e.g.*, encapsulation in liposomes (see, *e.g.*, Langer, *Science* 249(4976):1527-1533 (1990) ; Treat *et al.*, in *Liposomes in the Therapy of Infectious Disease and Cancer*, Lopez-Berestein *et al.*, eds., Liss (1989) at pages 353-365), microparticles, microcapsules, or recombinant cells capable of expressing the antibody, antigen-binding antibody fragment, fusion polypeptide or analog of the invention.

[0219] Methods of administering an antibody, antigen-binding antibody fragment, fusion polypeptide or analog of the invention, or pharmaceutical composition comprising same include, but are not limited to, parenteral (*e.g.*, intradermal, intramuscular, intraperitoneal, intravenous and subcutaneous administration), epidural, or mucosal (*e.g.*, intranasal and oral) routes of administration. See, *e.g.*, U.S. Patent Nos. 5,679,377, 5,702,727, 5,783,193, 5,817,624, 6,074,689, 6,156,731, 6,174,529, 6,187,803, 6,331,175, and 6,387,406. In a specific embodiment, an antibody, antigen-binding antibody fragment, fusion polypeptide or analog of the invention, or a pharmaceutical composition thereof is administered intramuscularly, intravenously, or subcutaneously. The compositions may be administered by any convenient route, for example, by infusion or bolus injection, by absorption through epithelial or mucocutaneous linings (*e.g.*, oral mucosa, rectal and intestinal mucosa, *etc.*) and may also be administered together with other biologically active agents. Administration can be systemic or local. In addition, pulmonary administration can

also be employed, *e.g.*, by use of an inhaler or nebulizer, and formulation with an aerosolizing agent. See, *e.g.*, U.S. Patent Nos. RE37,525, 5,290,540, 5,855,913, 5,874,064, 5,934,272, 5,985,309, 5,985,320, 6,019,968, 6,165,463, 6,358,530, and 6,402,733 and PCT Publication No. WO 99/66903, each of which is incorporated herein by reference in its entirety. In one embodiment, an antibody, a fusion protein, a conjugated molecule, or a pharmaceutical composition can be administered using Alkermes AIR™ pulmonary drug delivery technology (Alkermes, Inc., Cambridge, MA).

[0220] In one preferred embodiment, the pharmaceutical composition is formulated in accordance with routine procedures so that it is adapted for intravenous administration to human beings. Typically, pharmaceutical compositions for intravenous administration are solutions in sterile isotonic aqueous buffer. Where necessary, the composition may also include a solubilizing agent and a local anesthetic to ease pain at the site of the injection.

[0221] In another specific embodiment, it may be desirable to administer the pharmaceutical compositions of the invention locally to the area in need of treatment. This may be achieved by local infusion, injection, or by means of an implant, said implant being of a porous, non-porous, or gelatinous material.

[0222] In yet another embodiment, the methods are practiced as part of a combination therapy, for example, a combination cancer therapy. Such combination cancer therapy can include, for example, administration of a chemotherapeutic agent, *e.g.*, cisplatin, ifosfamide, paclitaxel, taxanes, a topoisomerase I inhibitor (*e.g.*, CPT-11, topotecan, 9-AC, or GG-211), gemcitabine, mitomycin, emetine, etoposide, tenoposide, vincristine, vinblastine, colchicin, doxorubicin, daunorubicin, dihydroxy anthracin dione, mitoxantrone, mithramycin, vinorelbine, oxaliplatin, 5-fluorouracil (5-FU), leucovorin, vinorelbine, temodal, or taxol. Such combination cancer therapy can alternatively or additionally include, but is not limited to, radiation therapy.

[0223] The use of the term “combination therapy “ or “combination cancer therapy” does not limit the order in which agents or treatments are administered to a subject with a CA 125/O772P-related disorder. For example, the agents of the combination therapy can be administered concurrently, sequentially in any order or cyclically to a subject. In a preferred embodiment, the two or more components of the combination therapy are administered to a subject concurrently. The term “concurrently” is not limited to the administration of two or more agents at exactly the same time, but rather it is meant that the agents are administered to

a subject in a sequence and within a time interval such that the agents can act together to provide an increased benefit than if they were administered otherwise.

[0224] The agents to be administered as part of combination therapy methods can, for example, be administered to a subject in the same pharmaceutical composition.

Alternatively, the agents of the combination therapies can be administered to a subject in separate pharmaceutical compositions, by the same or different routes of administration.

#### **5.9. Methods of Diagnosing a CA 125/O772P-Related Disorder**

[0225] In another aspect, the present invention also provides methods for diagnosing a CA 125/O772P-related disorder or predisposition to a CA 125/O772P-related disorder. In one embodiment, labeled antibodies, antigen-binding antibody fragments, fusion polypeptides, and analogs of the invention can be used for diagnostic purposes to detect, diagnose, or monitor a CA 125/O772P-related disorder such as cancer.

[0226] For example, antibodies, antigen-binding antibody fragments, fusion polypeptides, and analogs of the invention can be used to assay cell-associated CA 125/O772P levels in a biological sample using classical immunohistological methods as described herein or as known to those of skill in the art (see, *e.g.*, Jalkanen *et al.*, J. Cell. Biol. 101(3):976-984 (1985); Jalkanen *et al.*, J. Cell. Biol. 105(6 Pt 2):3087-3096 (1987)). Other antibody-based methods useful for detecting protein gene expression include immunoassays, such as the enzyme linked immunosorbent assay (ELISA) and the radioimmunoassay (RIA). Suitable antibody assay labels are known in the art and include, for example, enzyme labels, such as, alkaline phosphatase, glucose oxidase; radioisotopes, such as iodine ( $^{125}\text{I}$ ,  $^{131}\text{I}$ ), carbon ( $^{14}\text{C}$ ), sulfur ( $^{35}\text{S}$ ), tritium ( $^3\text{H}$ ), indium ( $^{111}\text{In}$ ), and technetium ( $^{99\text{m}}\text{Tc}$ ); luminescent labels, such as luminol; and fluorescent labels, such as fluorescein and rhodamine.

[0227] One aspect of the invention is the detection and diagnosis of a predisposition to cancer, in particular, ovarian cancer, in a human. In one embodiment, diagnosis comprises: a) administering (for example, parenterally, subcutaneously, or intraperitoneally) to a subject an amount of a labeled antibody, antigen-binding antibody fragment, fusion polypeptide, or analog that preferentially binds cell-associated CA 125/O772P effective for diagnosis, and b) detecting the labeled antibody, antigen-binding antibody fragment, fusion polypeptide, or analog in the subject in order to make said diagnosis. In accordance with this embodiment, the antibody, antigen-binding fragment, fusion polypeptide, or analog is preferably labeled with an imaging moiety which is detectable using an imaging system known to one of skill in the art. Background level can be determined by various methods including, comparing the

amount of labeled molecule detected to a standard value previously determined for a particular system.

[0228] Presence of the labeled molecule can be detected in the subject using methods known in the art for *in vivo* scanning. These methods depend upon the type of label used. Skilled artisans will be able to determine the appropriate method for detecting a particular label. Methods that may be used in the diagnostic methods of the invention include, but are not limited to, computed tomography (CT), whole body scan such as positron emission tomography (PET), magnetic resonance imaging (MRI), and sonography.

[0229] In a specific embodiment, the molecule is labeled with a radioisotope and is detected in the subject using a radiation responsive surgical instrument (see, *e.g.*, U.S. Patent No. 5,441,050). In another embodiment, the molecule is labeled with a fluorescent compound and is detected in the subject using a fluorescence responsive scanning instrument. In another embodiment, the molecule is labeled with a positron emitting metal and is detected in the subject using PET. In yet another embodiment, the molecule is labeled with a paramagnetic label and is detected in the subject using MRI.

[0230] It will be understood in the art that the size and weight of the subject, as well as the type of the imaging system used, will determine the type and quantity of imaging moiety needed to produce useful diagnostic images. In the case of a  $^{99m}\text{Tc}$ -containing radioisotope moiety, for a human subject, the quantity of radioactivity injected will normally range from about 5 to 20 millicuries. The labeled antibody, antigen-binding antibody fragment, fusion polypeptide, or analog will then preferentially accumulate at the location of cells which exhibit a cell-associated CA 125/O772P polypeptide. *In vivo* tumor imaging is described in Burchiel *et al.*, "Immunopharmacokinetics of Radiolabeled Antibodies and Their Fragments", in *Tumor Imaging: The Radiochemical Detection of Cancer*, Burchiel *et al.*, eds., Masson Publishing Inc. (1982) at Chapter 13.

[0231] Depending on several variables, including the type of label used and the mode of administration, the time interval following the administration for permitting the labeled molecule to preferentially concentrate at sites in the subject and for unbound labeled molecule to be cleared to background level may be about 6 to 48 hours or about 6 to 24 hours or about 6 to 12 hours. In another embodiment the time interval following administration is about 5 to 20 days or about 5 to 10 days.

[0232] In one embodiment, monitoring of a CA 125/O772P-related disorder, *e.g.*, cancer, can be carried out by repeating the imaging method at several time points, for

example, at one month after initial diagnosis, at six months after initial diagnosis, and/or at one year after initial diagnosis, and so forth.

[0233] Included within the invention are methods of diagnosing or monitoring cancer comprising administering to a subject in need of such diagnosis or monitoring an amount of the labeled antibody, antigen-binding antibody fragment, fusion polypeptide, or analog that preferentially binds cell-associated CA 125/O772P sufficient for detection, and detecting the labeled antibody, antigen-binding antibody fragment, fusion polypeptide, or analog bound to an organ or tissue of the subject. Furthermore, the present invention provides methods of detecting cell-associated CA 125/O772P in a biological sample comprising contacting a labeled antibody, antigen-binding antibody fragment, fusion polypeptide, or analog that preferentially binds cell-associated CA 125/O772P, and detecting antibody, antigen-binding antibody fragment, fusion polypeptide, or analog bound to the sample.

[0234] In these embodiments, the amount of labeled molecule bound to cell-associated CA 125/O772P can then be compared to a standard amount or to a control, or to the amount previously detected in the subject at an earlier time point.

#### **5.10. Methods of Producing Antibodies**

[0235] Antibodies of the invention can be produced by any method known in the art for the synthesis of antibodies, for example, by hybridoma technology, chemical synthesis or preferably, by recombinant expression techniques.

[0236] Polyclonal antibodies can be produced by various procedures well-known in the art. For example, a human CA 125/O772P comprising a cell-associated CA 125/O772P polypeptide can be administered to various host animals including, but not limited to, rabbits, mice, rats, and horses, to induce the production of sera containing polyclonal antibodies specific for the human antigen. Various adjuvants may be used to increase the immunological response, depending on the host species, and include but are not limited to, Freund's (complete or incomplete), mineral gels such as aluminum hydroxide, surface active substances such as lysolecithin, pluronic polyols, polyanions, peptides, oil emulsions, keyhole limpet hemocyanins, dinitrophenol, and potentially useful human adjuvants such as BCG (bacille Calmette-Guerin) and *Corynebacterium parvum*. Such adjuvants are also well known in the art.

[0237] Monoclonal antibodies can be prepared using a wide variety of techniques known in the art including the use of hybridoma, recombinant, and phage display technologies, or a combination thereof. For example, monoclonal antibodies can be produced using hybridoma techniques including those known in the art and taught in Harlow *et al.*,



*Antibodies: A Laboratory Manual*, 2<sup>nd</sup> ed., Cold Spring Harbor Laboratory Press (1988); or Hammerling *et al.*, *Monoclonal Antibodies and T-Cell Hybridomas*, Elsevier (1981) at pages 563-681), which are hereby incorporated by reference in their entireties.

[0238] Methods for producing and screening for specific antibodies using hybridoma technology are routine and well known in the art. Briefly, in one example, mice can be immunized with a CA 125/O772P polypeptide, *e.g.*, a cell-associated CA 125/O772P polypeptide and once an immune response is detected, *e.g.*, antibodies specific for the antigen are detected in the mouse serum, the mouse spleen is harvested and splenocytes isolated. The splenocytes are then fused by well known techniques to any suitable myeloma cells, for example, cells from cell line SP2/0-Ag14 available from the ATCC (Accession No. CRL-1581). Hybridomas are selected and cloned by limiting dilution. The hybridoma clones are then assayed by methods known in the art for cells that secrete antibodies capable of binding a cell-associated CA 125/O772P. Ascites fluid, which generally contains high levels of antibodies, can be generated by injecting mice with positive hybridoma clones.

[0239] Accordingly, the present invention provides methods of generating monoclonal antibodies as well as antibodies produced by such methods comprising culturing a hybridoma cell secreting an antibody of the invention wherein, preferably, the hybridoma is generated by fusing splenocytes isolated from a mouse immunized with a CA 125/O772P polypeptide, *e.g.*, a cell-associated CA 125/O772P polypeptide, with myeloma cells, and then screening the hybridomas resulting from the fusion for hybridoma clones that secrete an antibody able to bind to the CA 125/O772P polypeptide, *e.g.*, a cell-associated CA 125/O772P polypeptide.

[0240] Antibody fragments which recognize specific epitopes may be generated by any technique known to those of skill in the art. For example, Fab and F(ab')<sub>2</sub> fragments of the invention may be produced by proteolytic cleavage of immunoglobulin molecules, using enzymes such as papain (to produce Fab fragments) or pepsin (to produce F(ab')<sub>2</sub> fragments). F(ab')<sub>2</sub> fragments contain the variable region, the light chain constant region and the CH1 domain of the heavy chain. Further, the antibodies of the present invention can also be generated using various phage display methods known in the art.

[0241] In phage display methods, functional antibody domains are displayed on the surface of phage particles which carry the polynucleotide sequences encoding them. Phage expressing an antigen binding domain that binds to a CA 125/O772P polypeptide antigen can be selected or identified with antigen, *e.g.*, using labeled antigen or antigen bound or captured to a solid surface or bead. Examples of phage display methods that can be adapted so they can be used to make or identify the antibodies of the present invention include those

disclosed in Brinkmann *et al.*, J. Immunol. Methods. 182(1):41-50 (1995); Ames *et al.*, J. Immunol. Methods. 184(2):177-186 (1995); Kettleborough *et al.*, Eur. J. Immunol. 24(4):952-958 (1994); Persic *et al.*, Gene. 187(1):9-18 (1997); Burton *et al.*, Adv. Immunol. 57:191-280 (1994); PCT publication Nos. WO 91/10737 and WO 95/15982; EP 853,661; and U.S. Patent Nos. 5,223,409, 5,403,484, 5,427,908, 5,516,637, 5,571,698, 5,580,717, 5,658,727, 5,667,988, 5,698,426, 5,712,089, 5,733,743, 5,780,225, 5,789,208, 5,821,047, 5,885,793, 5,969,108, 6,096,551, 6,140,470, 6,376,170, 6,265,150 and 6,335,163; each of which is incorporated herein by reference in its entirety.

[0242] As described in the above references, after phage selection, the antibody coding regions from the phage can be isolated and used to generate whole antibodies, including human antibodies, or a desired antigen binding fragment, and expressed in a host, including mammalian cells, insect cells, plant cells, yeast, and bacteria, *e.g.*, as described below. Techniques to recombinantly produce Fab, Fab' and F(ab')<sub>2</sub> fragments can also be employed using methods known in the art such as those disclosed in U.S. Patent Nos. 5,595,898, 5,698,417, and 6,204,023; Mullinax *et al.*, BioTechniques. 12(6):864-869 (1992); Sawai *et al.*, Am. J. Reprod. Immunol. 34(1):26-34 (1995); and Better *et al.*, Science. 240(4855):1041-1043 (1988); each of which is incorporated herein by reference in their entireties.

[0243] To generate whole antibodies, PCR primers including VH or VL nucleotide sequences, a restriction site, and a flanking sequence to protect the restriction site can be used to amplify the VH or VL sequences in scF<sub>v</sub> clones. Utilizing cloning techniques known to those of skill in the art, the PCR amplified VH domains can be cloned into vectors expressing a VH constant region, and the PCR amplified VL domains can be cloned into vectors expressing a VL constant region, *e.g.*, human kappa or lambda constant regions. Preferably, the vectors for expressing the VH or VL domains can comprise an EF-1 $\alpha$  promoter, a secretion signal, a cloning site for the variable domain, constant domains, and a selection marker such as neomycin. The VH and VL domains may also be cloned into one vector expressing the necessary constant regions. The heavy chain expression vectors and light chain expression vectors are then co-transfected into cell lines to generate stable or transient cell lines that express full-length antibodies, *e.g.*, IgG, using techniques known to those of skill in the art.

[0244] For some uses, particularly *in vivo* use of antibodies in humans and *in vivo* detection assays, it may be preferable to use chimeric, humanized, or completely human antibodies. A chimeric antibody is a molecule in which different portions of the antibody are derived from immunoglobulin molecules from different species. For example, and not by

way of limitation, a chimeric antibody may have light and/or heavy chain variable regions derived from a murine antibody and light and/or heavy chain constant regions derived from a human immunoglobulin. Methods for producing chimeric antibodies are known in the art. See, *e.g.*, Morrison, *Science*. 229(4719):1202-1207 (1985); Oi *et al.*, *BioTechniques*. 4(3):214-221 (1986); Gillies *et al.*, *J. Immunol. Methods*. 125(1-2):191-202 (1989); and U.S. Patent Nos. 4,816,397, 4,816,567, and 5,807,715, each of which is incorporated herein by reference in their entirety.

[0245] A humanized antibody is an antibody that comprises a human framework, including a human constant region, and one or more CDRs from an antibody of a non-human species, *e.g.*, a murine species. Such humanized antibodies can routinely be generated utilizing a variety of techniques known in the art including, for example, CDR-grafting (EP 239,400; PCT publication No. WO 91/09967; and U.S. Patent Nos. 5,225,539, 5,530,101, 5,585,089, 5,766,886, 5,859,205, 6,180,370, and 6,407,213), veneering or resurfacing (U.S. Patent No. 5,639,641; EP 519,596; Padlan, *Mol. Immunol.* 28(4/5):489-498 (1991); Studnicka *et al.*, *Protein Eng.* 7(6):805-814 (1994); and Roguska *et al.*, *Proc. Natl. Acad. Sci. USA*. 91(3):969-973 (1994)), and chain shuffling (U.S. Patent Nos. 5,565,332 and 6,455,253). In a preferred embodiment, humanized antibodies comprise a CDR having an amino acid sequence of any one of the CDRs listed in Table 1, Table 2, Table 3, Table 4, Table 5 or Table 6 and human framework regions. Often, framework residues in the framework regions will be substituted with the corresponding residue from the CDR donor antibody to alter, preferably improve, antigen binding. These framework substitutions are identified by methods well known in the art, *e.g.*, by modeling of the interactions of the CDR and framework residues to identify framework residues important for antigen binding and sequence comparison to identify unusual framework residues at particular positions. See, *e.g.*, U.S. Patent Nos. 5,585,089, 5,770,196, and 5,869,619; and Riechmann *et al.*, *Nature*. 332(6162):323-327 (1988), each of which is incorporated herein by reference in their entireties.

[0246] Completely or fully human antibodies are desirable for therapeutic treatment of human subjects. Human antibodies can be made by a variety of methods known in the art, including the phage display methods described above using antibody libraries derived from human immunoglobulin sequences. See also U.S. Patent Nos. 4,444,887, 4,716,111, 5,916,771, 5,939,598, 6,075,181, 6,114,598, 6,150,584, 6,162,963, 6,235,883; PCT publication WO 98/46645; and EP 463,151; each of which is incorporated herein by reference in its entirety.

[0247] Human antibodies can also be produced using transgenic mice which are incapable of expressing functional endogenous immunoglobulins, but which can express human immunoglobulin genes. For example, the human heavy and light chain immunoglobulin gene complexes may be introduced randomly or by homologous recombination into mouse embryonic stem cells. Alternatively, the human variable region, constant region, and diversity region may be introduced into mouse embryonic stem cells in addition to the human heavy and light chain genes. The mouse heavy and light chain immunoglobulin genes may be rendered non-functional separately or simultaneously with the introduction of human immunoglobulin loci by homologous recombination. In particular, homozygous deletion of the JH region prevents endogenous antibody production. The modified embryonic stem cells are expanded and microinjected into blastocysts to produce chimeric mice. The chimeric mice are then bred to produce homozygous offspring which express human antibodies. The transgenic mice are immunized in the normal fashion with a selected antigen, *e.g.*, all or a portion of a CA 125/O772P polypeptide, such as a cell-associated CA 125/O772P polypeptide. Monoclonal antibodies directed against the antigen can be obtained from the immunized, transgenic mice using conventional hybridoma technology. The human immunoglobulin transgenes harbored by the transgenic mice rearrange during B cell differentiation, and subsequently undergo class switching and somatic mutation. Thus, using such a technique, it is possible to produce therapeutically useful IgG, IgA, IgM and IgE antibodies. For an overview of this technology for producing human antibodies, see Lonberg *et al.*, *Int. Rev. Immunol.* 13(1):65-93 (1995). For a detailed discussion of this technology for producing human antibodies and human monoclonal antibodies and protocols for producing such antibodies, see, *e.g.*, U.S. Patent Nos. 5,413,923, 5,625,126, 5,633,425, 5,569,825, 5,661,016, 5,545,806, 5,814,318, 5,939,598, 6,075,181, 6,091,001, 6,114,598, 6,150,584, and 6,162,963, which are incorporated by reference herein their entirety. In addition, companies such as Abgenix, Inc. (Fremont, CA) and Genpharm (San Jose, CA) can be engaged to provide human antibodies directed against a selected antigen using technology similar to that described above.

[0248] Completely human antibodies which recognize a selected epitope can be generated using a technique referred to as “guided selection.” In this approach a selected non-human monoclonal antibody, *e.g.*, a mouse antibody, is used to guide the selection of a completely human antibody recognizing the same epitope. See, *e.g.*, Jespers *et al.*, *Bio/Technology.* 12(4):899-903 (1994).

[0249] Further, the antibodies that specifically bind to an antigen can, in turn, be utilized to generate anti-idiotypic antibodies that “mimic” an antigen using techniques well known to those skilled in the art, and anti-anti-idiotypic antibodies that bind to the antigen can be prepared therefrom. See, *e.g.*, Greenspan *et al.*, FASEB J. 7(5):437-444 (1993); and Nisonoff, J. Immunol. 147(8):2429-2438 (1991).

#### **5.11. Recombinant Expression of Antibodies and Polypeptides**

[0250] Recombinant expression of an antibody, antigen-binding antibody fragment, fusion polypeptide or analog that preferentially binds cell-associated CA 125/O772P can be accomplished using an expression vector comprising a polynucleotide that encodes the antibody, antigen-binding antibody fragment, fusion polypeptide or analog of the invention. Once a polynucleotide encoding an antibody, antigen-binding antibody fragment, fusion polypeptide or analog of the invention has been obtained, the vector for the production of the antibody, antigen-binding antibody fragment, fusion polypeptide or analog may be produced by recombinant DNA technology using techniques well-known in the art. See, *e.g.*, U.S. Patent Nos. 4,816,567, 5,545,405, and 6,331,415, each of which is incorporated herein by reference in its entirety.

[0251] Methods which are well known to those skilled in the art can be used to construct expression vectors containing antibody, antigen-binding antibody fragment, fusion polypeptide or analog coding sequences and appropriate transcriptional and translational control signals. These methods include, for example, *in vitro* recombinant DNA techniques, synthetic techniques, and *in vivo* genetic recombination. The invention, therefore, provides replicable vectors comprising a nucleotide sequence encoding an antibody of the invention, antigen-binding antibody fragment of the invention, fusion polypeptide or analog of the invention, a heavy or light chain of an antibody, a heavy or light chain variable domain of an antibody or a portion thereof, or a heavy or light chain CDR, operably linked to a promoter. Such vectors may also include the nucleotide sequence encoding the constant region of the antibody molecule (see, *e.g.*, EP 216,846, EP 323,997, and U.S. Patent No. 5,122,464), and the variable domain of the antibody may be cloned into such a vector for expression of the entire heavy chain, the entire light chain, or both the entire heavy and light chains.

[0252] The expression vector is transferred to a host cell by conventional techniques and the transformed or transfected cells are then cultured by conventional techniques, under conditions that are conducive to, or permit, the production of an antibody, antigen-binding antibody fragment, fusion polypeptide or analog of the invention. Thus, the invention includes host cells containing a vector or polynucleotide encoding an antibody, antigen-

binding antibody fragment, fusion polypeptide or analog of the invention or fragment thereof, or a heavy or light chain thereof, or portion thereof, or a single chain antibody of the invention, which polynucleotide molecule is operably linked to a heterologous promoter. In preferred embodiments for the expression of double-chained antibodies, vectors encoding both the heavy and light chains may be co-expressed in the host cell for expression of the entire immunoglobulin molecule, as detailed below.

[0253] A variety of host-expression vector systems may be utilized to express the antibodies, antigen-binding, antibody fragments, fusion polypeptides or analogs of the invention (see, *e.g.*, U.S. Patent No. 5,807,715). Such host-expression systems represent vehicles by which the coding sequences of interest may be produced and subsequently purified, but also represent cells which may, when transformed or transfected with the appropriate nucleotide coding sequences, express antibodies antigen-binding, antibody fragments, fusion polypeptides or analogs of the invention *in situ*. These include, but are not limited to, microorganisms such as bacteria (*e.g.*, *E. coli* or *B. subtilis*) transformed with recombinant bacteriophage DNA, plasmid DNA or cosmid DNA expression vectors containing antibody, antigen-binding antibody fragment, fusion polypeptide or analog coding sequences; yeast (*e.g.*, *Saccharomyces cerevisiae*, *Pichia pastoris*, or *Pichia maetlanolica*) transformed with recombinant yeast expression vectors containing antibody, antigen-binding antibody fragment, fusion polypeptide or analog coding sequences; insect cell systems transfected with recombinant virus expression vectors (*e.g.*, baculovirus) containing antibody, antigen-binding antibody fragment, fusion polypeptide or analog coding sequences; plant cell systems transfected with recombinant virus expression vectors (*e.g.*, cauliflower mosaic virus, CaMV; tobacco mosaic virus, or TMV) or transformed with recombinant plasmid expression vectors (*e.g.*, Ti plasmid) containing antibody, antigen-binding antibody fragment, fusion polypeptide or analog coding sequences; or mammalian cell systems (*e.g.*, COS, CHO, BHK, 293, NS0, or 3T3 cells) harboring recombinant expression constructs containing promoters derived from the genome of mammalian cells (*e.g.*, metallothionein promoter) or from mammalian viruses (*e.g.*, the adenovirus late promoter or the vaccinia virus 7.5K promoter). Preferably, bacterial cells such as *Escherichia coli*, and more preferably, eukaryotic cells, especially for the expression of whole recombinant antibody molecule, are used for the expression of a recombinant antibody molecule. For example, mammalian cells such as Chinese hamster ovary (CHO) cells, in conjunction with a vector such as the major intermediate early gene promoter element from human cytomegalovirus are an effective expression system for antibodies (Foecking *et al.*, *Gene*. 45(1):101-105 (1986) and Cockett *et*

*al.*, Bio/Technology. 8(7):662-667 (1990)). In a specific embodiment, the expression of nucleotide sequences encoding antibodies, antigen-binding antibody fragments, fusion polypeptides or analogs of the invention are regulated by a constitutive promoter, inducible promoter, cell type or tissue specific promoter.

[0254] In bacterial systems, a number of expression vectors may be advantageously selected depending upon the use intended for the antibody, antigen-binding antibody fragment, fusion polypeptide or analog being expressed. For example, when a large quantity of such a protein is to be produced, *e.g.*, for the generation of pharmaceutical compositions of an antibody molecule, vectors which direct the expression of high levels of protein products that are readily purified may be desirable. Such vectors include, but are not limited to, the *E. coli* expression vector pUR278 (Ruther *et al.*, EMBO J. 2(10):1791-1794 (1983)), in which the antibody coding sequence may be ligated individually into the vector in frame with the lacZ coding region so that a fusion protein is produced; pIN vectors (Inouye *et al.*, Nucleic Acids Res. 13(9):3101-3110 (1985); Van Heeke *et al.*, J. Biol. Chem. 264(10):5503-5509 (1989)); and the like. pGEX vectors may also be used to express foreign polypeptides as fusion proteins with glutathione S-transferase (GST) (Hakes *et al.*, Anal. Biochem. 202(2):293-298 (1992)). In general, such fusion proteins are soluble and can easily be purified from lysed cells by adsorption and binding to matrix glutathione agarose beads followed by elution in the presence of free glutathione. The pGEX vectors are designed to include thrombin or factor Xa protease cleavage sites so that the cloned target gene product can be released from the GST moiety.

[0255] In an insect system, *Autographa californica* nuclear polyhedrosis virus (AcNPV) is used as a vector to express foreign genes. The virus grows in *Spodoptera frugiperda* cells. The antibody coding sequence may be cloned individually into non-essential regions (for example, the polyhedrin gene) of the virus and placed under control of an AcNPV promoter (for example, the polyhedrin promoter). See, *e.g.*, Kumar *et al.*, Biosci. Rep. 19(3):227-234 (1999).

[0256] In mammalian host cells, a number of viral-based expression systems may be utilized. In cases where an adenovirus is used as an expression vector, the antibody, antigen-binding antibody fragment, fusion polypeptide or analog coding sequence may be ligated to an adenovirus transcription/translation control complex, *e.g.*, the late promoter and tripartite leader sequence. This chimeric gene may then be inserted in the adenovirus genome by *in vitro* or *in vivo* recombination. Insertion in a non-essential region of the viral genome (*e.g.*, region E1 or E3) will result in a recombinant virus that is viable and capable of expressing the

antibody molecule infected hosts (see, *e.g.*, Logan *et al.*, Proc. Natl. Acad. Sci. USA. 81(12):3655-3659 (1984)). Specific initiation signals may also be required for efficient translation of inserted coding sequences. These signals include the ATG initiation codon and adjacent sequences. Furthermore, the initiation codon must be in frame with the reading frame of the desired coding sequence to ensure translation of the entire insert. These exogenous translational control signals and initiation codons can be of a variety of origins, both natural and synthetic. The efficiency of expression may be enhanced by the inclusion of appropriate transcription enhancer elements, transcription terminators, etc. (see, *e.g.*, Bitter *et al.*, Methods Enzymol. 153:516-544 (1987)).

[0257] In addition, a host cell strain which modulates the expression of the inserted sequences, or modifies and processes the gene product in a specific desired fashion may be utilized. Such modifications (*e.g.*, glycosylation) and processing (*e.g.*, cleavage) of protein products may be important for the function of the protein. Different host cells have characteristic and specific mechanisms for the post-translational processing and modification of proteins and gene products. Appropriate cell lines or host systems can be chosen to ensure the correct modification and processing of the foreign protein expressed. To this end, eukaryotic host cells which possess the cellular machinery for proper processing of the primary transcript, glycosylation, and phosphorylation of the gene product may be used. Such mammalian host cells include, but are not limited to, CHO, VERO, BHK, Hela, COS, MDCK, 293, 3T3, W138, BT483, Hs578T, HTB2, BT2O and T47D, NS0 (a murine myeloma cell line that does not endogenously produce any immunoglobulin chains), CRL7030 and HsS78Bst cells.

[0258] For long-term, high-yield production of recombinant proteins, stable expression of the protein is preferred. For example, cell lines which stably express the antibody molecule may be engineered. Rather than using expression vectors which contain viral origins of replication, host cells can be transformed with DNA controlled by appropriate expression control elements (*e.g.*, promoter sequences, enhancer sequences, transcription terminators, polyadenylation sites, etc.), and a selectable marker. Following the introduction of the foreign DNA, engineered cells may be allowed to grow for 1-2 days in an enriched media, and then switched to a selective media. The selectable marker in the recombinant plasmid confers resistance to the selection and allows cells to stably integrate the plasmid into their chromosomes and grow to form foci which in turn can be cloned and expanded into cell lines. This method may advantageously be used to engineer cell lines which stably express the antibody molecule.



[0259] A number of selection systems may be used, including but not limited to, the herpes simplex virus thymidine kinase (Wigler *et al.*, Cell. 11(1):223-232 (1977)), hypoxanthineguanine phosphoribosyltransferase (Spring *et al.*, Biochim. Biophys. Acta. 2118(2):158-162 (1994)), and adenine phosphoribosyltransferase (Lowy *et al.*, Cell. 22(3):817-823 (1980)) genes can be employed in tk-, hgp<sup>rt</sup>- or ap<sup>rt</sup>- cells, respectively. Also, antimetabolite resistance can be used as the basis of selection for the following genes: *dhfr*, which confers resistance to methotrexate (Wigler *et al.*, Proc. Natl. Acad. Sci. USA. 77(6):3567-3570 (1980); O'Hare *et al.*, Proc. Natl. Acad. Sci. USA. 78(3):1527-1531 (1981)); *gpt*, which confers resistance to mycophenolic acid (Mulligan *et al.*, Proc. Natl. Acad. Sci. USA. 78(4):2072-2076 (1981)); neo, which confers resistance to the aminoglycoside G-418 (Wu *et al.*, Biotherapy. 3(1):87-95 (1991); Tolstoshev, Ann. Rev. Pharmacol. Toxicol. 33:573-596 (1993); Mulligan, Science. 260(5110):926-932 (1993); and Morgan *et al.*, Ann. Rev. Biochem. 62:191-217 (1993)); and *hygro*, which confers resistance to hygromycin (Santerre *et al.*, Gene 30(1-3):147-156 (1984)). Methods commonly known in the art of recombinant DNA technology may be routinely applied to select the desired recombinant clone, and such methods are described, for example, in *Current Protocols in Molecular Biology*, Ausubel *et al.*, eds., John Wiley & Sons (1989-2002); Kriegler, *Gene Transfer and Expression, A Laboratory Manual*, Stockton Press (1990); Chapters 12 and 13 of *Current Protocols in Human Genetics*, Dracopoli *et al.*, eds., John Wiley & Sons (1994); and Colbere-Garapin *et al.*, J. Mol. Biol. 150(1):1-14 (1981), each of which is incorporated by reference herein their entireties.

[0260] The expression levels of an antibody, antigen-binding antibody fragment or fusion polypeptide molecule can be increased by vector amplification (for a review, see Bebbington *et al.*, *The Use of Vectors Based on Gene Amplification for the Expression of Cloned Genes in Mammalian Cells in DNA Cloning, Vol. 3*, Academic Press (1987)). When a marker in the vector system expressing antibody is amplifiable, increase in the level of inhibitor present in culture of host cell will increase the number of copies of the marker gene. Since the amplified region is associated with the antibody gene, production of the antibody will also increase (Crouse *et al.*, Mol. Cell. Biol. 3(2):257-266 (1983)).

[0261] The host cell may be co-transfected with two expression vectors of the invention, the first vector encoding a heavy chain derived polypeptide and the second vector encoding a light chain derived polypeptide. The two vectors may contain identical selectable markers which enable equal expression of heavy and light chain polypeptides. Alternatively, a single vector may be used which encodes, and is capable of expressing, both heavy and

light chain polypeptides. In such situations, the light chain should preferably be placed before the heavy chain to avoid an excess of toxic free heavy chain (Proudfoot, *Nature*. 322(6079):562-565 (1986); and Kohler, *Proc. Natl. Acad. Sci. USA*. 77(4):2197-2199 (1980)). The coding sequences for the heavy and light chains may comprise cDNA or genomic DNA, or a combination thereof.

[0262] Once an antibody, antigen-binding antibody fragment, fusion polypeptide or analog of the invention has been produced by recombinant expression, it may be purified by any method known in the art for purification of an immunoglobulin molecule, for example, by chromatography (*e.g.*, ion exchange, affinity, particularly by affinity for the specific CA 125/O772P antigen after initial Protein A purification, and sizing column chromatography), centrifugation, differential solubility, or by any other standard technique for the purification of proteins. Further, the antibodies of the present invention or fragments thereof may be fused to heterologous polypeptide sequences described herein or otherwise known in the art to facilitate purification.

[0263] The following examples are presented by way of illustration and not by way of limitation of the scope of the invention.

## **6. EXAMPLES**

[0264] The results provided herein demonstrate that an extracellular portion of CA 125/O772P remains in cell-associated form after a portion of the CA 125/O772P polypeptide is released as shed CA 125/O772P. In particular, the presence of cell-associated CA 125/O772P is demonstrated via the successful generation and characterization of several antibodies that preferentially bind the cell-associated CA 125/O772P species relative to the shed CA 125/O772P species. In addition to preferential binding, the results presented herein describe antibodies that exhibit a high degree of specificity for CA 125/O772P and affinity for the cell-associated CA 125/O772P antigen. Still further, the results presented herein demonstrate that such antibodies can function to mediate lysis of CA 125/O772P-positive tumor cells.

### **6.1. Antibody Generation**

[0265] The experiments provided herein describe the generation of monoclonal antibodies against an extracellular portion of CA 125/O772P. As demonstrated in subsequent subsections, antibodies generated via such techniques include ones that are specific for CA 125/O772P, preferentially bind cell-associated CA 125/O772P, exhibit a high degree of affinity for cell-associated CA 125/O772P, and can function to mediate lysis of CA 125/O772P-positive tumor cells.

Antigen and Antigen-Expressing Constructs:

[0266] Expression constructs were generated for expressing CA 125/O772P antigen for use in antibody production. The first antigen, designated O772P 3-repeat (FIG. 1; SEQ ID NO:1), to be expressed included the carboxyl-most three tandem repeats of the extracellular domain of CA 125/O772P, up to, but not including, the CA 125/O772P transmembrane sequence. The second antigen, designated O772P 3-repeat TM (FIG. 2; SEQ ID NO:2), to be expressed included the carboxyl-most three tandem repeats of the extracellular domain of CA 125/O772P as well as the transmembrane and cytoplasmic sequence depicted in FIG. 2. In particular, sequences encoding each of the antigens were subcloned into pSecTag2B vectors (Invitrogen). The vector encodes an Ig kappa signal sequence for secretion and myc and 6xhis tags for detection and purification of expressed protein.

Antigen Expression:

[0267] Recombinant antigen was produced by transiently transfecting suspension CHO-K1 cells with the constructs described above. Media used for the transfection was ProCHO CDM (BioWhittaker Inc. Walkersville, MD) with GS supplements (JRH Biosciences Lenexa, KS). To produce a liter of material, 2 mg of the transfection reagent Clonfection™ (Clontech, Palo Alto, Ca) was rehydrated, diluted into 24 ml of transfection media and incubated 15 minutes with 125 µg of DNA in the same media. The transfection mixture was added to 450 ml of transfection media containing  $1.25 \times 10^9$  suspension CHO-K1 cells and incubated 4 hours at 37°C on an orbital shaker. Following the incubation, 500 ml of ProCHO 4-CDM with GS supplements, penicillin-streptomycin and 10% ultra low IgG FBS (Life Technologies Rockville, MD) was added to the transfected cells and the culture was transferred into roller bottles. Samples were collected on day 3 and cultures were harvested on day 7.

Antigen Purification:

[0268] Transfection supernatant was concentrated to 250 ml using a Millipore Pellicon system with a 50K cut-off membrane. 2 ml Talon resin (Clontech, Palo Alto, CA), obtained from the TALON Purification kit (cat # K1253-1), was transferred to a 2 ml column and was washed with 20 ml 1X wash/extraction buffer (supplied with the kit, pH 7.0). Concentrated sample was then loaded onto the column at a flow rate of 1 ml/min. The column was then washed with 15 ml extraction/wash buffer. Bound protein was then eluted with 4x1 ml elution buffer (50 mM Na Phosphate, 300 mM NaCl, 150 mM imidazole, pH 7.0). One-half ml fractions were collected and analyzed by SDS-PAGE and visualized using Coomassie

Brilliant Blue G-250. Fractions containing O772P 3-repeat recombinant protein were further purified by Con-A Sepharose chromatography. One ml Con A Sepharose (Vector Laboratories, Inc., cat # AC-1003, lot # K0425) was transferred to a 15 ml conical centrifuge tube and washed with 10 ml 1X phosphate-buffered saline (PBS), pH 7.2. Wash buffer was removed by centrifugation. Fractions from TALON purification containing O772P 3-repeat protein were diluted 1:1 with 1X PBS, pH 7.2 and added to the washed ConA Sepharose and rotated overnight at 4°C. The resin slurry was then transferred to a 5 ml gravity-flow column and washed with 10 ml 1X PBS, pH 7.2. Samples were eluted with 0.6M methyl  $\alpha$ -D-mannopyranoside in 1X PBS, pH 7.2 in 0.5 ml fractions in a total volume of 6 ml. Fractions were analyzed by SDS-PAGE and visualized using Coomassie Brilliant Blue G-250. Fractions containing pure O772P 3-repeat protein were combined and dialyzed against 2L 1X PBS, pH 7.2 and stored at 4°C.

#### Immunization:

[0269] BALB/c mice were immunized intraperitoneally (i.p.) on Days 0, 21, 42, and 63. The first injection was with NIH:OVCAR-3 (ATCC HTB-161) cells and subsequent injections were with O772P 3-repeat protein without a transmembrane domain. Complete Freund's adjuvant was used for the first protein injection and incomplete Freund's adjuvant was used for the remaining injections. Serum was collected on days 35, 56, and 77 and analyzed by ELISA and flow cytometry as described below. Mice with the best serum titers were selected for cell fusion. On day one and two prior to fusion, the selected mice were boosted with mammalian expressed O772P 3-repeat protein i.p. and intravenously (i.v.). The day before the fusion the mice were boosted i.v.

#### Hybridoma production:

[0270] The mouse spleen was removed and spleen cells were harvested by mincing with forceps and straining the cells through a sieve. Cells were washed twice in IMDM medium and cell counts were performed. P3X63Ag8.653 mouse myeloma cells (ATCC CRL-1580) in log phase growth were harvested, washed twice in IMDM medium and cells were counted. Spleen cells and myeloma cells were mixed together in a ratio of 5:1 and centrifuged at 200 x g for 5 minutes. After aspiration, the pellet was loosened by tapping the bottom of the tube. One ml of a 50% solution of PEG (m.w. 1450) was added drop by drop over a period of 30 seconds and then the pellet was mixed gently for 30 seconds using a pipette. The resulting suspension was allowed to stand undisturbed for another 30 seconds. Five ml of IMDM were added over a period of 90 seconds followed by another 5 ml immediately. The resulting cell suspension was left undisturbed for 5 minutes. Following

centrifugation, the cells were resuspended in HAT medium (IMDM containing 10% FBS, 2 mM L-glutamine, 0.6% 2-mercaptoethanol (0.04% solution), hypoxanthine, aminopterin, thymidine, and 10% ORIGENÒ Hybridoma Cloning Factor (IGEN International, Gaithersburg, MD)) to a concentration of  $5 \times 10^5$  cells per ml and plated at 0.2 ml or  $1 \times 10^5$  cells per well into 96 well plates. Plates were incubated at 37°C in a 7% CO<sub>2</sub> atmosphere with 100% humidity. Seven days after fusion, the media was removed and replaced with IMDM containing 10% FBS, 2 mM L-glutamine, 0.6% 2-mercaptoethanol stock (0.04%), hypoxanthine and thymidine. Ten to fourteen days after fusion, the supernatant was taken from wells with growing hybridoma colonies and tested for binding to CA 125/O772P as discussed herein.

Purification of antibodies from hybridoma supernatants:

[0271] One-half ml protein G resin (Sigma, St. Louis, MO) was packed into a 5 ml disposable column (Bio-Rad, Hercules, CA). The column was pre-equilibrated with 20 ml binding buffer (20 mM PBS, pH 7.0). The hybridoma supernatant was loaded onto the column at a flow rate less than 0.5 ml/min. The column was then washed with 20 ml binding buffer at a flow rate of 1 ml/min. Alternatively, prepacked Protein G columns were used (Amersham Pharmacia Biotech). The antibody was then eluted with 3 ml elution buffer (0.1 M glycine, pH 2.7). 0.5 ml fractions were collected into 1 ml tubes containing 50 µl 1 M Tris, pH 9.0. Samples were dialyzed against PBS (0.5 L) and concentrated to approximately 1 mg/ml protein.

Antibody concentrations in hybridoma supernatants:

[0272] Concentrations of antibody were determined using Easy-Titer Mouse IgG Assay Kit. (Pierce Biotechnology, Rockford, IL). Briefly, Mouse IgG whole molecule standard (Pierce Biotechnology, Rockford, IL) was diluted to 500 ng/ml in dilution buffer (supplied with the kit). This standard was serially diluted 1:2 six times in dilution buffer to generate a standard curve. Twenty µl of each standard was added to corresponding wells in a 96-well plate. Dilutions of hybridoma supernatant (20 µl) were also added to the plate. Duplicate wells were done for each standard and sample. Twenty µl of polystyrene beads (supplied with the kit) were added to each well, the samples were mixed, the plate was sealed, and was incubated on a plate shaker for 5 minutes at room temperature. 100 µl of Blocking reagent from the kit was then added to each well. The plate was again shaken for 5 minutes at room temperature. The absorbance was then read at 405 nm on a Vmax plate reader (Molecular Devices Corp., Sunnyvale, CA) and a 4 parameter fit was used to generate the standard curve.

## 6.2. CA 125/O772P Specificity

[0273] The results presented herein demonstrate that antibody production via the techniques described above resulted in generation of antibodies specific for CA 125/O772P.

### ELISA Specificity Assay

#### Methods:

[0274] Ninety-six well plates were incubated and coated with 100  $\mu$ l (per well) of 1  $\mu$ g/ml O772P 3-repeat protein (SEQ ID NO:1) (affinity-purified) in bicarbonate buffer (0.2 M  $\text{Na}_2\text{CO}_3/\text{NaHCO}_3$ , pH 9.6, Sigma) overnight at 4 °C. On the next day, the plates were washed with 200  $\mu$ l 1 x PBST (1x phosphate-buffered saline (PBS), 0.05% Tween 20) three times and blocked with 100  $\mu$ l of 1 x PBST containing 1% bovine serum albumin (BSA) for 2 hours at 37 °C. After washing the plates with 1 x PBST three times, murine anti-CA 125/O772P selected hybridoma-produced antibodies (0.04 mg/ $\mu$ l) were added to the plates (individual wells). After 1 hour incubation at 37 °C, the plates were then washed with 1 x PBST three times. For signal detection, 100  $\mu$ l of HRP (horseradish peroxidase)-conjugated sheep anti-mouse IgG (1:2000 dilution into 1 x PBST + 1% BSA; Amersham Biosciences) was added to each well and incubated for 1 hour at 37 °C. The plates were again washed three times with 1 x PBST. Finally, 100  $\mu$ l of a mixture of TMB (3, 3', 5, 5'-tetramethylbenzidine) substrate and  $\text{H}_2\text{O}_2$  (1:1 ratio, KPL Kirkguard Perry Laboratories) was added into each well and after a 5 minute incubation, the absorbance was measured at 405 nm with a plate reader (Molecular Devices Corp., Sunnyvale, CA). The assay was done in triplicate for each selected O772P hybridoma-produced antibody and data was collected and analyzed as a kinetic assay, measured over a 5 minute time period. Average values were calculated and presented. Controls for blank and individual reagents were also included in each experiment.

#### Results:

[0275] Table 7, below, presents the ELISA Specificity Assay results for four selected anti-CA 125/O772P hybridoma-produced antibodies (117.1, 368.1, 501.1, 776.1). The table also shows the ELISA Specificity Assay results for two commercially available CA 125/O772P antibodies (OC125 and M11, Dako Corp., Carpinteria, CA). An antibody (or antigen-binding antibody fragment) is considered positive in this assay (*i.e.*, is specific for CA 125/O772P) if it exhibits an absorbance of at least 5 to greater than 30 OD/microgram antibody. These results demonstrate that each of the tested antibodies is specific for CA 125/O772P. It is noted, as demonstrated, below, that, although OC125 and M11 are considered specific for CA 125/O772P, neither antibody preferentially binds cell-associated CA 125/O772P relative to shed CA 125/O772P. SD = standard deviation.

TABLE 7

Ab name	absorbance (OD )	SD	absorbance (OD)/ $\mu$ g Ab
OC 125	0.73	0.003	18
M11	0.974	0.008	24
117.1	0.619	0.033	15
368.1	1.293	0.004	32
501.1	0.856	0.005	21
776.1	1.178	0.043	29

[0276] The results in Table 8, below, show absorbance data for twenty additional antibodies generated using the techniques described above. As shown by the absorbance data, each of these antibodies is also specific for CA 125/O772P.

TABLE 8

Ab name	absorbance (OD)/ $\mu$ g Ab
325.1	24
446.1	27
621.1	27
633.1	18
654.1	22
725.1	25
8G9	22
7F10	19
8A1	18
8C3	23
15C9	28
8E3	18
8B5	18
7G10	20
16C7	22
7C6	23
7H1	26
16H9	22
7A11	22
4E7	19

Flow Cytometry Specificity Assay:

Method:

[0277] Cells (OVCAR-3 (ATCC Accession No. HTB-161), SK-OV3 (ATCC Accession No. HTB-77), NIH/3T3 (ATCC Accession No. CRL-1658), and NIH/3T3 cells transfected with a sequence that expresses O772P 3-repeat protein (SEQ ID NO:2)) were removed from culture plates by digestion with trypsin (0.25%). The cells were counted and viability was assessed by trypan blue (0.2%) exclusion. Cells were then centrifuged (500xg, 5 min) and resuspended in FACS buffer (1x DPBS containing 1% BSA and 0.1% sodium azide) to a concentration between  $5\text{--}10 \times 10^7$  cells/ml. Cells were then distributed at a volume of 100  $\mu\text{l}$ /well into 96-well round bottom plates and centrifuged at 500xg for 3 minutes. Antibody supernatant was removed by aspiration, and 50  $\mu\text{l}$  hybridoma supernatants diluted to 1  $\mu\text{g}/\text{ml}$  and 0.5  $\mu\text{g}/\mu\text{l}$  in FACS buffer and was added to each well containing cells. Murine IgG1 kappa (Sigma, St. Louis, MO) (either 2.0, 1.0, 0.5, 0.1  $\mu\text{g}/\mu\text{l}$ ) was included as a negative control and OC125 and M11 (DAKO Corp, Carpinteria, CA) were included as positive controls. Plates were incubated for 30 minutes at 4°C with rocking. Cells were subsequently washed 2 times with FACS buffer (200  $\mu\text{l}$ /well), with centrifugation and buffer aspiration following each wash. Goat anti-mouse IgG (Fc)-biotin (Sigma, St. Louis, MO) was diluted 1:1000 in FACS buffer and 50  $\mu\text{l}$  was added to each well containing cells. Plates were incubated 30 minutes at 4°C with rocking. Cells were then washed with FACS buffer as above. Streptavidin-Alexa-Four 488 (Molecular Probes, Eugene, OR) was diluted 1:1000 into FACS buffer and 50  $\mu\text{l}$  was added to each well containing cells. Plates were then incubated 30 minutes at 4°C with washing. Cells were then washed with FACS buffer, as above. Cells were then resuspended in 1 ml of FACS buffer and transferred to Falcon 2052 tubes and analyzed on a Becton-Dickinson Immunocytometry Systems FACSCalibur flow cytometer (San Jose, CA).

#### Results:

[0278] Table 9, below, presents the Flow Cytometry Specificity Assay results from four selected anti-CA 125/O772P hybridoma-produced antibodies (117.1, 368.1, 501.1, 776.1). The table also shows the Flow Cytometry Specificity Assay results for the commercially available OC125 and M11. The NIH/3T3 cells and the SK-OV3 cells (an ovarian cancer cell line) were considered negative controls because neither produces CA 125/O772P.

[0279] Antibodies (or antigen-binding antibody fragments) are considered positive (that is, are specific for CA 125/O772P) if they exhibit a Flow Cytometry Specificity Assay result within the following positive cell ranges: less than about 5% positive NIH/3T3 cells, and at least about 60% positive NIH/3T3 cells producing a SEQ ID NO:2 polypeptide; or less



than about 25% positive SK-OV3 cells and at least about 80% positive OVCAR-3 cells. (nd – not determined)

[0280] These results demonstrate that each of the tested antibodies is specific for CA 125/O772P. It is noted, as demonstrated, below, that, although OC125 and M11 are considered specific for CA 125/O772P, neither of these two antibodies preferentially binds cell-associated CA 125/O772P relative to shed CA 125/O772P.

**TABLE 9**

Antibody	% positive - NIH/3T3 O772P 3-repeat	% positive - NIH/3T3	% positive - OVCAR-3	% positive - SK-OV3
OC 125 (1 $\mu$ g/ml)	nd	nd	98	16
OC 125 (0.1 $\mu$ g/ml)	nd	nd	85	10
M11 (1 $\mu$ g/ml)	84	0.1	98	17
M11 (0.1 $\mu$ g/ml)	nd	nd	91	11
117.1 (2 $\mu$ g/ml)	83	0.1	93	6
117.1 (0.5 $\mu$ g/ml)	63	0	nd	nd
368.1 (2 $\mu$ g/ml)	86	0.2	89	5
368.1 (0.5 $\mu$ g/ml)	75	0.2	nd	nd
501.1 (2 $\mu$ g/ml)	89	0	95	5
501.1 (0.5 $\mu$ g/ml)	85	0.2	nd	nd
776.1 (2 $\mu$ g/ml)	86	0	94	9
776.1 (0.5 mg/ml)	84	0	nd	nd

[0281] The results provided in Table 10, below, present OVCAR-3/SK-OV3 data for twenty additional antibodies generated as described above demonstrating that these antibodies, too, are specific for CA 125/O772P.

**TABLE 10**

Ab name	% positive OVCAR-3 (0.5 $\mu$ g/ml)	% positive SK-OV3 (2.0 $\mu$ g/ml)
325.1	98	6
446.1	94	5
621.1	97	9
633.1	89	9
654.1	86	8
725.1	96	10
8G9	97	4
7F10	96	3
8A1	97	3
8C3	97	3
15C9	95	3
8E3	95	1
8B5	94	1
7G10	96	2
16C7	96	3

7C6	96	3
7H1	96	0
16H9	96	3
7A11	94	1
4E7	97	2

**6.3. Competition Assays Demonstrate the successful Production of Antibodies that Preferentially Bind CA 125/O772P**

[0282] The results presented herein demonstrate that antibodies produced via the techniques described above can generate antibodies that preferentially bind cell-associated CA 125/O772P relative to shed CA 125/O772P. The fact that such antibodies can be generated also demonstrates, for the first time, that cell-associated CA 125/O772P polypeptides exist, *i.e.*, that an extracellular portion of CA 125/O772P remains in cell-associated form, however transiently, after a portion of the CA 125/O772P polypeptide is released as shed CA 125/O772P.

**ELISA Competition Assay:**

**Method:**

[0283] Ninety-six well plates were coated with 100  $\mu$ l (per well) of 1  $\mu$ g/ml O772P 3-repeat (SEQ ID NO:1) polypeptide (affinity-purified) in bicarbonate buffer (0.2 M Na<sub>2</sub>CO<sub>3</sub>/NaHCO<sub>3</sub>, pH 9.6, Sigma) overnight at 4 °C. On the next day, the plates were washed with 200  $\mu$ l 1 X PBST (1 X phosphate-buffered saline (PBS), 0.05% Tween 20) three times and blocked with 100  $\mu$ l of 1 X PBST containing 1% bovine serum albumin (BSA) for 2 hours at 37 °C. After washing with 1 X PBST three times, selected anti-CA 125/O772P hybridoma-produced antibodies at indicated concentrations (*e.g.*, 0.04  $\mu$ g/ml) were added to wells that had been pre-incubated for 20-30 minutes with excess amounts (*e.g.*, 10-50 fold w/w) of shed CA 125/O772P (Fitzgerald Industries International, Concord, MA; Scripps Laboratories, La Jolla, CA; and/or United States Biological Corp.). After 1 hour incubation at 37 °C, the plates were then washed with 1 X PBST three times. For signal detection, 100  $\mu$ l of HRP-conjugated sheep anti-mouse IgG (1:2000 dilution into 1 X PBST + 1% BSA, Amersham Biosciences) was added to each well and incubated for 1 hour at 37 °C. The plates were washed again with 1 X PBST three times. Finally, 100  $\mu$ l of a mixture of TMB substrate and H<sub>2</sub>O<sub>2</sub> (1:1 ratio, KPL) was added into each well and the absorbance was measured at 405 nm with a plate reader (Molecular Devices Corp., Sunnyvale, CA). The assay was done in triplicate for each selected antibody and average values were calculated and presented. The percent inhibition compared to no competition was calculated for individual antibodies based

on average values. Controls for blank and individual reagents were also included in each experiment.

**Results:**

[0284] Table 11, below, presents the ELISA Competition Assay results for four selected anti-CA 125/O772P hybridoma-produced antibodies (117.1, 368.1, 501.1, 776.1). The table also shows the ELISA Competition Assay results for the commercially available CA 125/O772P antibody (OC125; DAKO Corp., Carpinteria, CA). An antibody (or antigen-binding antibody fragment) is considered positive in this assay (that is, preferentially binds cell-associated CA 125/O772P) if it exhibits less than about 25% inhibition of binding at 25-fold (w/w) excess shed CA 125/O772P. These results demonstrate that each of antibodies 117.1, 368.1, 501.1 and 776.1 preferentially binds cell-associated CA 125/O772P. These results also demonstrate that OC125 antibody fails to preferentially bind cell-associated CA 125/O772P. (SD-standard deviation)

**TABLE 11**

antibody	absorbance	SD	absorbance w/ shed CA 125/O772P competitor (25-fold w/w excess)	SD	percent inhibition of binding	absorbance w/ O772P 3-repeat competitor (10x w/w excess)	SD	percent inhibition of binding
OC 125	0.73	0.003	0.074	0.001	95	0.047	0.002	99
117.1	0.619	0.033	0.554	0.007	11	0.071	0.001	94
368.1	1.293	0.004	1.333	0.009	0	0.915	0.016	30
501.1	0.856	0.005	0.735	0.008	15	0.065	0.002	96
776.1	1.178	0.043	0.977	0.01	17	0.077	0.001	96

[0285] The results presented in Table 12, below, present CA 125/O772P competitor data for twenty additional antibodies generated via the techniques described above demonstrating that these antibodies, too, represent antibodies that preferentially bind cell-associated CA 125/O772P.

**TABLE 12**

Ab name	% inh. binding w/shed CA 125/O772 competitor (25-fold excess))
325.1	2
446.1	7
621.1	2
633.1	7
654.1	9
725.1	7
8G9	7

7F10	6
8A1	8
8C3	5
15C9	5
8E3	4
8B5	6
7G10	3
16C7	3
7C6	2
7H1	4
16H9	0
7A11	5
4E7	7

#### Flow Cytometry Competition Assay:

##### Method:

[0286] NIH:OVCAR-3 (ATCC Accession No. HTB-161) cells were removed from culture plates by digestion with trypsin (0.25%). Cells were then counted and viability was assessed by trypan blue (0.2%) exclusion. Cells were then centrifuged (500xg, 5 min) and resuspended in FACS buffer (1 X DPBS containing 1% BSA and 0.1% sodium azide) to a concentration between  $5-10 \times 10^7$  cells/ml. Cells were then distributed (100  $\mu$ l/well) into 96-well round bottom plates and centrifuged 500xg for 3 minutes. Supernatants were removed by aspiration. Hybridoma supernatants were diluted to 0.2  $\mu$ g/ml of antibody in FACS buffer. CA 125 (Fitzgerald Industries International, Concord, MA) was diluted to 1000  $\mu$ g/ml, 500  $\mu$ g/ml, 200  $\mu$ g/ml, 60  $\mu$ g/ml, 20  $\mu$ g/ml, 6  $\mu$ g/ml, or 2  $\mu$ g/ml in FACS buffer. Thirty  $\mu$ l antibody solution was incubated with 30  $\mu$ l diluted CA 125 or buffer alone for 30 minutes at 4°C. 50  $\mu$ l of the mixture was added to each well containing cells. Murine IgG1 kappa (Sigma, St. Louis MO) and M11 (DAKO Corp, Carpinteria, CA) were included as negative and positive controls, respectively. Plates were incubated for 30 minutes at 4°C with rocking. Cells were subsequently washed 2 times with FACS buffer (200  $\mu$ l/well), with centrifugation and aspiration of buffer following each wash. Goat anti-mouse IgG (Fc)-biotin (Sigma, St. Louis, MO) was diluted 1:1000 in FACS buffer and 50  $\mu$ l was added to each well containing cells. Plates were incubated 30 min at 4°C with rocking. Cells were then washed with FACS buffer as above. Streptavidin-Alexa-Four 488 (Molecular Probes, Eugene, OR) was diluted 1:1000 into FACS buffer and 50  $\mu$ l was added to each well containing cells. Plates were then incubated 30 minutes at 4°C with washing. Cells were then washed with FACS buffer, as

above. Cells were then resuspended in 1 ml of FACS buffer and transferred to Falcon 2052 tubes and analyzed on a Becton-Dickinson Immunocytometry Systems FACSCalibur flow cytometer (San Jose, CA). Percent positive cells was plotted as a function of CA 125/O772P concentration using GraphPad plotting software. IC<sub>50</sub> determinations, expressed as the concentration of shed CA 125/O772P at which 50 % inhibition of binding is seen, were made using a linear regression analysis.

Results:

[0287] FIG. 3 shows a representative plot of shed CA 125/O772P concentration versus percent positive cells for, in this instance, 117.1 antibody and M11 antibody control (squares).

[0288] Table 13, below, presents a summary of Flow Cytometry Competition Assay results. An antibody (or antigen-binding antibody fragment) is considered positive (that is, is considered to preferentially bind cell-associated CA 125/O772P) if it exhibits an IC<sub>50</sub>, as measured by percent-positive cells, of at least about 0.05 mg/ml shed CA 125/O772P.

[0289] The results shown in Table 13, below, demonstrate that each of 117.1, 501.1, 776.1, 8C3, 16H9, 325.1, 633.1 and 725.1 antibodies preferentially binds cell-associated CA 125/O772P. It is noted that the results in Table 13 also demonstrate that the OC125 and M11 antibodies do not preferentially bind cell-associated CA 125/O772P.

TABLE 13

antibody	IC <sub>50</sub> (mg/ml CA 125) function of % positive cells
OC 125	0.005
M11	0.01
117.1	>1.0
368.1	nd
501.1	0.13
776.1	0.19
8C3	>0.5
16H9	>0.5
325.1	0.36
621.1	>0.5
633.1	0.18
725.1	0.42
446.1	nd
654.1	nd
8G9	nd
7F10	nd
8A1	nd
15C9	nd
8E3	nd

8B5	nd
7G10	nd
16C7	nd
7C6	nd
7H1	nd
7A11	nd

#### 6.4. Affinity Assay

[0290] The results presented herein demonstrate that among the antibodies generated that preferentially bind CA 125/O772P, are antibodies that exhibit a high degree of affinity for cell-associated CA 125/O772P.

##### BIAcore Affinity Assay: Methods:

[0291] A GM5 BIAcore biosensor chip was docked into the BIAcore X instrument and activated with 55  $\mu$ l of 1:1 NHS/EDC at room temperature. O772P 3-repeat region protein and BSA at 10  $\mu$ g/ml in 0.05 M acetate buffer, pH 4.5, were immobilized onto the flow cell (FC) 1 and FC2 of the activated chip, respectively, at a flow rate of 5  $\mu$ l/min to achieve a resonance response of 1000-2000 RU. The chip was then blocked by injection of 55  $\mu$ l of ethanolamine-HCl, pH 8.5, and followed with washing 5 times with 50 mM NaOH-1 M NaCl. To measure the binding of anti-O722P mAbs to the O772P 3-repeat region immobilized to the chip, 30  $\mu$ l of anti-O722P mAbs at varying concentrations in BIAcore running buffer (HBS-EP, Cat. #1001-080, BIAcore, Piscataway, NJ) were injected over the sensor surface at a flow rate of 5  $\mu$ l/min. Following completion of the injection phase, dissociation was monitored in BIAcore running buffer at the same flow rate for 360 seconds. The surface was regenerated between injections using 30  $\mu$ l of 50 mM NaOH-1 M NaCl. Individual sensorgrams were analyzed using BIAevaluation.

##### BIAcore Affinity Assay: Results:

[0292] Table 14, below, presents a summary of BIAcore Affinity Assay results for 117.1, 368.1, 501.1 and 776.1 antibodies, as well as for M11 and OC125 antibodies. As shown in the table, each of antibodies 117.1, 368.1, 501.1, 776.1, 4E7, 7C6, 7F10, 7G10, 7H1, 8A1, 8B5, 8C3, 8E3, 15C9, 16C7, 16H9, 325.1, 621.1, 633.1 and 725.1 bind with high affinity to CA 125/O772P polypeptide.

TABLE 14

antibody	K <sub>d</sub> (nM)
M11	1.6
OC125	4
117.1	12
368.1	0.7

antibody	K <sub>d</sub> (nM)
501.1	70
776.1	0.4
4E7	30
7A11	nd
7C6	73
7F10	3.7
7G10	47
7H1	69
8A1	2.8
8B5	32
8C3	5.0
8E3	33
8G9	14
15C9	14
16C7	44
16H9	3.9
325.1	15
446.1	nd
621.1	40
633.1	26
654.1	190
725.1	2.6

#### 6.5. **Functional Assays:**

[0293] The results presented herein demonstrate that among the antibodies generated that preferentially bind cell-associated CA 125/O772P are antibodies that can function to mediate lysis of CA 125/O772P-positive tumor cells.

##### ADCC Assay:

##### Method:

[0294] Human leukocytes were isolated from peripheral blood of normal donors by a Histopaque-1077 gradient centrifugation procedure (Sigma Co., St. Louis, MO) and used as effector cells. In U-bottom, 96-well plates, OVCAR-3 target cells ( $5 \times 10^3$  /well) were mixed with Histopaque-purified human leukocytes at effector-to-target (E/T) ratios of 12.5:1 to 50:1 in the absence or presence of varying concentrations of monoclonal antibodies in a total volume of 120  $\mu$ l of RPMI 1640 supplemented with 10% FBS. The plates were incubated at 37°C in a humidified 5% CO<sub>2</sub> atmosphere. Target cells and effector cells without the testing antibody were used as negative controls. Following 16 – 18 hr. incubation, 50  $\mu$ l aliquots of culture supernatant were collected and assayed for lactate dehydrogenase activity in flat-bottom, 96-well plates using the Cytotox 96 Non-radioactive

Cytotoxicity Assay Kit (Promega Co., Madison, WI) according to manufacturer's instructions. Percent lysis of tumor cells was calculated as follows: % Cytotoxicity = (experimental release – effector spontaneous release – target spontaneous release)/(target maximum release – target spontaneous release) x 100. The results were expressed as mean percentage lysis  $\pm$  S.D. of replicate samples.

Results:

[0295] FIG. 4 shows a representative plot of percent lysis versus antibody concentration for 117.1 antibody (average of 4 separate donors). As shown in the figure, 117.1 antibody mediates lysis of OVCAR-3 ovarian cancer cells in a dose-dependant manner

CDC Assay:

[0296] In U-bottom, 96-well plates, OVCAR-3 target cells ( $2 \times 10^4$ /well) are mixed with human or guinea pig complement diluted 15:1, 20:1, 25:1 in the absence or presence of varying concentrations of antibody in a total volume of 120  $\mu$ l of RPMI 1640 supplemented with 10% FBS. The plates are incubated at 37°C in a humidified 5% CO<sub>2</sub> atmosphere. Target cells without antibody are used as negative controls. Following 4 hr. incubation, 50  $\mu$ l aliquots of culture supernatant are collected and assayed for lactate dehydrogenase activity in flat-bottom, 96-well plates using the Cytotox 96 Non-radioactive Cytotoxicity Assay Kit (Promega Co., Madison, WI) according to the manufacturer's instructions. Percentage lysis of tumor cells is calculated as follows: % Cytotoxicity = (experimental release-effector spontaneous release - target spontaneous release)/(target maximum release - target spontaneous release) x 100. Results are expressed as mean percentage lysis  $\pm$  S.D. of replicate samples.

**6.6. Sequences of Antibodies that Preferentially Bind Cell-Associated CA 125/O772P**

[0297] The results presented herein provide the amino acid and nucleotide sequences for the variable regions of six of the monoclonal antibodies described herein: 117.1, 368.1, 501.1, 776.1, 725.1 and 16H9, including CDR sequences.

Methods:

[0298] Hybridoma cells were harvested and pelleted at 1800 rpm for 10 minutes at 4°C. One ml of TRIzol (Invitrogen) was added per  $10^7$  cells and total RNA was processed. Two hundred  $\mu$ l of chloroform per 1 ml of TRIzol Reagent was added, shaken vigorously by hand for 15 sec. and centrifuged at 12,000 x g for 15 minutes at 4 °C. The aqueous phase containing the RNA was transferred to a fresh tube and precipitated by adding 500  $\mu$ l of isopropyl alcohol per 1 ml of TRIzol Reagent used for the initial homogenization. The RNA



pellet was washed once with 70% EtOH and briefly air-dried before being resuspended in DEPC water. Three  $\mu$ g of total RNA were treated with 10 units of calf intestinal phosphatase (CIP) for 1 hour at 50° C to remove the 5' phosphates. This step eliminated truncated mRNA and non-mRNA from subsequent steps. Dephosphorylated RNA was treated with 0.5 units of tobacco acid pyrophosphatase (TAP) for 1 hour at 37° C to remove the 5' cap structure from intact, full length mRNA. The GeneRacer RNA Oligo (5'-CGACUGGAGCACGAGGACACUGACAUGGACUGAAGGAGUAGAAA-3'; SEQ ID NO:43) was ligated to the 5' end of the mRNA using 5 units of T4 RNA Ligase for 1 hour at 37° C. The ligated mRNA was reverse-transcribed using 5 units of AMV-Reverse Transcriptase and the GeneRacer Oligo dT Primer (5'-GCTGTCAACGATACGCTACGTAACGGCATGACAGTG(T)<sub>18</sub>-3'; SEQ ID NO:44) for 1 hour at 42° C to create cDNA with known priming sites at the 5' and 3' ends. The 5' ends were amplified using a gene-specific 3' primer located in the constant region of the desired gene (heavy chain 5'-AYCTCCACACACAGGRRCCAGTGGATAGAC (SEQ ID NO:45), light chain 5'-GGATACAGTTGGTGCAGCATC-3' (SEQ ID NO:46)) and the GeneRacer 5' Primer homologous to the GeneRacer RNA Oligo (5'-CGACTGGAGCACGAGGACACTGA-3'; SEQ ID NO:47). The PCR reaction was carried out using 2  $\mu$ l of cDNA by denaturing the template at 94° C for 5 min. and then denaturing at 94° C for 30 sec., annealing at 55° C for 30 sec., elongating at 72° C for 1 minute for 30 cycles and elongating for a final cycle at 72° C for 7 min. on a GeneAmp 9700 PCR System. Bands of interest were gel purified using the Qiagen Gel Purification Kit and cloned using the TOPO-4 Cloning Kit (Invitrogen). Resultant isolated colonies were screened by PCR for insert of the correct size in a GeneAmp 9700 machine. PCR was performed by lysing the bacteria at 94° C for 8 min, then denaturing at 94° C for 30 sec., annealing at 55° C for 30 sec., elongating at 72° C for 1-4 minutes for 25 cycles and elongating for a final cycle at 72° C for 7 min. Primers used for screening were: sense, 5'-ATTAACCCTCACTAAAGGGA-3' (SEQ ID NO:48) or 5'-TAATACGACTCACTATAGGG-3' (SEQ ID NO:49), antisense heavy or light chain constant region primers (see above). Positive clones were grown in a 4 ml overnight culture to amplify the clone and a SNAP Miniprep (Invitrogen) was performed. Clones were then sequenced using the BigDye (Perkin Elmer) chemistry in a GeneAmp 9700 PCR System for 25 cycles by denaturing the DNA for 10 sec. at 94° C, annealing the primer (5'-ATTAACCCTCACTAAAGGGA-3' (SEQ ID NO:50) or 5'-TAATACGACTCACTATAGGG-3' (SEQ ID NO:51)) at 50° C for 5 sec. and elongating the

primer for 4 min. at 72° C. The reactions were then passed over a DyeEx Column (Qiagen) and sequenced on an Applied Biosystems 310 automated DNA sequencer.

**Results:**

[0299] Nucleic acid sequences that encode the variable regions of six monoclonal antibodies that preferentially bind cell-associated CA 125/O772P were obtained and are depicted in FIGS 5-10. In particular, FIGS. 5A, 6A, 7A, 8A, 9A and 10A depict the nucleotide sequences that encode the variable light chain regions of monoclonal antibodies 117.1, 368.1, 501.1, 776.1, 725.1 and 16H9, respectively, while FIGS. 5B, 6B, 7B, 8B, 9B and 10B depict the nucleotide sequences that encode the variable heavy chain regions of monoclonal antibodies 117.1, 368.1, 501.1, 776.1, 725.1 and 16H9, respectively. The nucleotide sequences that encode leader sequences are double underlined, and the nucleotide sequences that encode CDR sequences are underlined.

[0300] Amino acid sequences of the variable regions of six monoclonal antibodies that preferentially bind cell-associated CA 125/O772P were obtained and are depicted in FIGS. 5-10. In particular, FIGS. 5C, 6C, 7C, 8C, 9C and 10C depict the amino acid sequences of the variable light chain regions of monoclonal antibodies 117.1, 368.1, 501.1, 776.1, 725.1 and 16H9, respectively, while FIGS. 5D, 6D, 7D, 8D, 9D and 10D depict the amino acid sequences of variable heavy chain regions of monoclonal antibodies 117.1, 368.1, 501.1, 776.1, 725.1 and 16H9, respectively. Leader sequences are double underlined, and CDR sequences are underlined. It is noted that the leader sequences do not become part of the mature antibodies, and, as such, are not considered a part of the variable regions of the antibodies.

**6.7. Western Blot Analysis of OVCA-3 Supernatants**

[0301] The working example presented herein provides a western blot analysis designed to test directly the ability of antibodies 368.1 or 776.1 to bind shed CA 125/O772P. The data presented herein directly demonstrates that neither the 368.1 nor the 776.1 antibody recognize the high molecular weight species corresponding to shed CA 125/O772P. In contrast, antibodies OC 125 and M11 did recognize this high molecular weight species, while all of the antibodies tested bind strongly to the control 3-repeat-containing recombinant O772P polypeptide. Thus, these data provide additional confirmation that the 368.1 and the 776.1 antibodies preferentially bind cell-associated CA 125/O772P polypeptide.

Methods:

[0302] Media (RPMI supplemented with 10% fetal bovine serum) from cultured OVCAR-3 cells was removed and replaced with fresh supplemented media. Aliquots of conditioned media were removed at 1 hour, 6 hours, 24 hours, 48 hours and 72 hours. Supplemented media was used as the time 0 point.

[0303] A 4-12% Bis-Tris (Invitrogen) gel was loaded with 10 µl of conditioned media from each time point and separated by electrophoresis for 45 minutes at 200 volts. Purified O772P 3-repeat polypeptide was loaded as a positive control at 100 ng, 10 ng and 1.0 ng.

[0304] Proteins were transferred to a nitrocellulose membrane for one hour at 30 volts and then blocked overnight in non-fat milk at 4°C. Primary antibodies were brought to 400 µg/ml in PBS and then diluted 1:1000 in non-fat milk (OC125 Dako #M3519, M11 Dako #M3520). The blots were washed in PBS/Tween three times for 10 min. The secondary antibody (anti-mouse IgG Fc-specific, Sigma #B-7410) was diluted 1:1000 in non-fat milk and incubated for 1 hour at room temperature. Washes were performed as above. NeutraAvidin-HRP (Molecular Probes #A-2664) was diluted 1:1000 in PBS/Tween and incubated at room temperature for 15 minutes. The blots were washed in a large volume of PBS-Tween and visualized by chemiluminescence (30 sec. exposure).

Results:

[0305] To determine if 368.1 or 776.1 antibody binds to shed CA 125/O772P polypeptide, a western blot analysis was performed on the supernatant of cultured OVCAR-3 cells, which are known to shed CA 125/O772P from their surface. Such an analysis tests the antibodies' ability to bind shed CA 125/O772P directly.

[0306] As shown in FIG. 11, the results of the western analysis demonstrate that neither the 368.1 nor the 776.1 antibody recognize the high molecular weight species that corresponds to shed CA 125/O772P. In contrast, antibodies M11 and OC 125, that is, antibodies that do not preferentially bind cell-associated CA 125/O772P, did recognize this high molecular weight species. All four of the antibodies tested bind strongly to the control 3-repeat-containing recombinant O772P polypeptide, O772P 3-repeat, which contains extracellular domain sequences that are immediately adjacent to the CA 125/O772P transmembrane domain. Thus, these data provide additional confirmation that the 368.1 and the 776.1 antibodies preferentially bind cell-associated CA 125/O772P polypeptide.

## 6.8. Radiolabeled 776.1 Antibody Slows Tumor Growth

[0307] The results presented herein demonstrate that radiolabeled 776.1 antibody successfully slows tumor growth in an animal model for human ovarian cancer.

### Methods:

#### Animals

[0308] Female NCr nu/nu (“nude”) mice (Taconic Farms, Germantown, N.Y.) 6-7 weeks old were used for all studies. All animals were given food and water *ad libitum*.

#### Tumor Cell Implantation

[0309] For efficacy studies, the OVCAR-3 human ovarian carcinoma cell line was used for the model of human ovarian cancer. The OVCAR-3 cell line (Hamilton, *et al.*, Cancer Res. 43:5379-5389 (1983)); was derived from an ovarian adenocarcinoma of human origin and was purchased from ATCC (Catalog # HTB-161). OVCAR-3 cells were maintained in RPMI-1640 supplemented with 10% FBS at 37°C in 5% CO<sub>2</sub>. OVCAR-3 expresses the tumor-associated CA 125/O772P on the cell surface. OVCAR-3 xenografts were subcutaneously implanted and grown as ectopic tumors in immune-deficient NCr nude mice. The major criterion for subcutaneous OVCAR-3 tumor growth was to achieve 150-250 mm<sup>3</sup> tumors by two weeks post implantation, at which time experimental therapy would begin.

[0310] In order to facilitate subcutaneous tumor formation, the OVCAR-3 line was serially propagated *in vivo* within the peritoneal cavities of NCr nu/nu mice (Burbridge *et al.*, Int. J. Oncol. 15: 1155-1162 (1999); Guichard *et al.*, Clin. Cancer Res. 7: 3222-3228 (2001)). Prior to subcutaneous implantation, 10 x 10<sup>6</sup> *in vitro* cultured OVCAR-3 cells (passage 32) in 0.9% saline were injected i.p. into NCr nu/nu mice (passage 1). Seven weeks later tumor cells were harvested by peritoneal lavage and 5 x 10<sup>6</sup> cells were injected into a new set of recipients (passage 2). Four weeks later the cells were harvested by peritoneal lavage and passaged once more and 5 x 10<sup>6</sup> cells were injected into a new set of recipients (passage 3). After three weeks passage 3 cells were harvested and assayed for CA 125/O772P expression and viability.

[0311] For the radioimmunotherapeutic studies, passage 3 cells were implanted for subcutaneous tumor growth. Passage 3 cells were routinely > 95% viable and retained high-levels of CA 125/O772P expression as confirmed by flow cytometry. For ectopic, solid tumor growth, cells were resuspended to a final concentration of 15 × 10<sup>6</sup> cells/ml in a mixture of

Matrigel (Matrigel, BD Biosciences: Lot #005002, 14.6mg/mL) and 0.9% saline with the final Matrigel concentration being 7.3mg/mL. Mice were injected with 0.2 ml volume of the cell suspension for a final dose of  $3 \times 10^6$  cells. The cell suspensions were injected subcutaneously on the ventral side of the abdominal area using a 23-gauge needle. The injection site was rendered aseptic by swabbing with sterile gauze in 70% ethanol. Approximately 10 days post-implantation palpable tumors were measured with electronic calipers (Fowler Instruments) across two perpendicular dimensions. Mice were sorted into groups of 10 based on tumor volume. For all groups within a study, there were no significant differences between mean tumor volumes. Tumor measurements and observation were recorded twice a week. Tumor volume was calculated using the standard formula (Length x Width<sup>2</sup>) x 0.5.

#### **Coupling of 776.1 to <sup>131</sup>Iodine**

[0312] Murine IgG1 776.1 was iodinated at Perkin-Elmer by the modified IODO-GEN method (Visser *et al.*, J. Nucl. Med. 42: 509-519 (2001)) which is an efficient means of coupling high doses of <sup>131</sup>I to a monoclonal antibody while minimizing both chemical and radiation induced damage. Ten microliters of a 1.41 mg/ml solution of ascorbic acid pH 5.0 was added to 10 mCi of <sup>131</sup>I and the mixture was incubated for one minute. This was followed by the addition of 100 µl of 0.5M phosphate pH 7.4. 0.5 mg of 776.1 mAb was then added (calculated using the antibody concentration to establish the volume required). This was followed by the addition of 35 µl of a 1 mg/ml solution of IODO-GEN in acetonitrile. After a 3 minute incubation, 100 µl of a solution of ascorbic acid (25 mg/ml, pH 5.0) was added. After another 5 minutes, 100 µl of 0.1 % murine serum albumen (MSA) in 50 mM PBS was added. After another 4 minute incubation, <sup>131</sup>I incorporation was analyzed by instant thin layer chromatography (ITLC) in normal saline. Unincorporated iodine was removed by separation using Sephadex G-25 chromatography with pre-packed NAP-10 columns (Amersham-Pharmacia) with PBS containing 0.1% MSA as buffer. All procedures were performed at room temperature. Purified mAb was analyzed for free iodine content again by ITLC, and was considered suitable if free iodine was <5% of the total iodine present.

#### **Immunoreactivity of radiolabeled 776.1 by ELISA**

[0313] The immunoreactivity of radiolabeled 776.1 was determined by ELISA assay. Immulon 4 (Dynatech) 96 well plates were coated with 100µl per well of O772P 3-repeat with a hemagglutinin (HA) tag (affinity-purified) at 1µg/ml in DPBS overnight at 4°C. The next day, the plates were blocked with 200µl per well of blocking buffer (1X PBS with 1% BSA) for 1 hour at room temperature. Unlabeled and radiolabeled 776.1 were diluted to 3µg/ml in blocking buffer and added to the first row of the blocked plate in triplicate at 150µl per well; 100µl of blocking buffer was added to the remaining wells. Antibodies were then serially diluted threefold for a total of 7 dilutions. The plate was incubated for 1 hour at room temperature followed by three washes with DPBS containing 0.05% Tween-20 (PBST; 200µl per well). For signal detection, 100µl of HRP-conjugated goat anti-mouse IgG (Amersham Biosciences Piscataway, NJ), diluted 1:2000, was added to each well and incubated for 1 hour at room temperature. The plates were washed three times with PBST and the HRP conjugate was detected by adding a mixture of TMB (KPL) substrate and H<sub>2</sub>O<sub>2</sub> (1:1 ratio; 100 µl/well). Plates were incubated for 10 minutes and the absorbance was measured at 650nm using a plate reader (Molecular Devices). Immunoreactivity was determined by comparing the concentrations of radiolabeled and unlabeled antibody where 50% saturation was achieved.

#### **Single-dose radioimmunotherapy (RIT) with [<sup>131</sup>I]776.1**

[0314] Mice bearing established OVCAR-3 tumors (ideally ranging in volume from 150 mm<sup>3</sup> to 250 mm<sup>3</sup>) were administered a single i.v. injection of [<sup>131</sup>I]776.1 (mouse IgG<sub>1</sub>) in 0.2 ml 0.9% sodium chloride. For all studies, groups of 10 mice received either 100 or 300 µCi of [<sup>131</sup>I]776.1 in 0.9% sodium chloride. Control groups consisted of mice injected with 0.9% sodium chloride alone or unlabeled 776.1 at a dose equivalent to the protein dose given in the high-dose radiolabeled 776.1 group. Tumors were measured two times per week. Mice were sacrificed when the tumor volume was greater than 10% of their body weight.

#### **Results:**

[0315] [<sup>131</sup>I]776.1 IgG<sub>1</sub> antibody, administered as a single, intravenous dose in an OVCAR-3 xenograft tumor model of human ovarian cancer, was effective in slowing tumor growth compared with IgG<sub>1</sub> control in three studies at the 300 µCi dose, and in two of three studies at the 100 µCi dose. See FIG. 12 for a summary of one of the studies. Compared

with saline control, [ $^{131}\text{I}$ ]776.1 IgG1 was effective in slowing tumor growth in two of three studies at both the 100  $\mu\text{Ci}$  and 300  $\mu\text{Ci}$  doses. In two of three studies, [ $^{131}\text{I}$ ]776.1 IgG1 at the 300  $\mu\text{Ci}$  dose demonstrated tumor regression, defined as achieving a mean tumor volume less than the starting tumor volume at the beginning of the study. In one study, no statistical slowing of tumor growth was observed for either [ $^{131}\text{I}$ ]776.1 IgG1 treatment group compared with saline control and no regression was observed for the 300  $\mu\text{Ci}$  [ $^{131}\text{I}$ ]776.1 IgG1 dose group. Starting mean tumor volumes at the beginning of this particular study were, however, significantly larger than in the remaining two studies.

[0316] Similar results were obtained using a [ $^{90}\text{Y}$ ]776.1 radiolabeled antibody. In particular, a significant reduction in tumor growth ( $p < 0.05$ ) was observed. In three of four studies, significant reduction in growth was observed at both 50  $\mu\text{Ci}$  and 150  $\mu\text{Ci}$  doses of the antibody. In these same three studies, regression of tumor growth was observed at the highest dose of [ $^{90}\text{Y}$ ]776.1, and the effect on tumor growth was equal to, or better than 3 doses of 6 mg/kg cisplatin.

#### **7.0. ANTIBODY/ANTIGEN-BINDING ANTIBODY FRAGMENT COMPETITION ASSAYS**

##### **ELISA Cross-Competition Assay**

[0317] Antibodies to be tested are biotinylated using the EZ-Link Sulfo-NHS-LC-Biotinylation Kit (Pierce Biotechnology, Rockford, IL), according to the manufacturer's instructions, followed by removal of unreacted biotinylation reagent by dialysis against 1L phosphate-buffered saline with 2 buffer changes at 4°C for 48 hours. Ninety-six well plates are coated with 100  $\mu\text{l}$  (per well) of 1  $\mu\text{g/ml}$  3 rpt-O772P in bicarbonate buffer (0.2 M  $\text{Na}_2\text{CO}_3/\text{NaHCO}_3$ , pH 9.6, Sigma) overnight at 4 °C.

[0318] The next day, the plates are washed three times with 200  $\mu\text{l}$  1 x PBST (1x phosphate-buffered saline (PBS), 0.05% Tween 20) and blocked with 100  $\mu\text{l}$  of 1 x PBST containing 1% bovine serum albumin (BSA) for 1 hour at room temperature. After three washes with 1 x PBST, a titration curve from 0- to 1000-fold excess competitor antibody (relative to the labeled antibody added at a later step) in 95  $\mu\text{l}$  1 x PBST + 1% BSA which is added to the plate in separate wells and incubated for 1 hour at 37 °C. Biotinylated antibody is then added in 5  $\mu\text{l}$  1 x PBST + 1% BSA, and incubated for an additional 1 hour at room temperature. The concentration of biotinylated antibody added is that concentration at which 70% maximal binding of O772P 3-rpt protein is achieved in the absence of competitor using

the detection conditions described below. The amount of antibody added is dependant upon the binding characteristics and is routinely determined empirically in pilot studies.

[0319] The plates are then washed three times with 1 x PBST. For signal detection, 100 µl of Streptavidin-HRP (1:4000-1:8000 dilution into 1 x PBST + 1% BSA, Southern Biotechnology Associates, Inc. (Birmingham, Alabama)), is added into each well and incubated for 1 hour at room temperature. The plates are then washed three times with 1 x PBST. Finally, 100 µl mixture of TMB substrate and H<sub>2</sub>O<sub>2</sub> (1:1 ratio, KPL) is added into each well and the absorbance is measured at 405 nm with a plate reader (Molecular Devices Corp., Sunnyvale, CA). The assay is done in triplicate for each antibody and average values are calculated.

[0320] Non-specific competition is determined using normal mouse IgG1 in place of specific competitor. Controls for blank and individual reagents, as well as self-competition, are also included in each experiment. Percent inhibition (minus non-specific competition) is plotted as a function of competitor competition, and the IC<sub>50</sub>, or the concentration of competitor at which 50% competition is observed is determined.

#### **FACS Cross-Competition Assay**

[0321] Antibodies to be tested are biotinylated using the EZ-Link Sulfo-NHS-LC-Biotinylation Kit (Pierce Biotechnology, Rockford, IL), according to the manufacturer's instructions, followed by removal of unreacted biotinylation reagent by dialysis against 1L phosphate-buffered saline with 2 buffer changes at 4°C for 48 hours. Cultured OVCAR-3 cells are harvested and washed in FACS buffer (1 x Dulbecco's phosphate-buffered saline (DPBS), 0.05% NaN<sub>3</sub>, 2% BSA). Competition assays are prepared in 96 well plates in a 50 µl total volume.

[0322] A titration from 0- to 1000-fold excess of unlabeled competitor antibody (relative to the biotinylated antibody added at a later step) in 20 µl is added to 25 µl of OVCAR-3 cells (4 x 10<sup>5</sup>) suspended in FACS buffer (in separate wells), thoroughly mixed, dispensed into a 96 well plate, and incubated at room temperature for 30 minutes. Five microliters of biotinylated antibody in FACS buffer are then added to each well containing cells, thoroughly mixed, and incubated at room temperature for an additional 30 minutes. The amount of antibody used is the minimal concentration at which maximal binding of OVCAR-3 cells, expressed as percent positive cells, is achieved. The amount of antibody



added is dependant upon the binding characteristics and is routinely determined empirically in pilot studies.

[0323] Cells are then collected and washed twice with 200  $\mu$ l of FACS buffer. For signal detection, cells are incubated with 50  $\mu$ l of 1  $\mu$ g/ml for FITC-conjugated streptavidin (prepared with FACS buffer, Molecular Probes, Eugene, OR) for 30 minutes at room temperature. After washing twice with 200  $\mu$ l of FACS buffer, cells from individual wells are then resuspended in 400  $\mu$ l of FACS buffer and subjected to FACS analysis. FACS analysis was performed according to manufacturer's recommendation using FACScan instrumentation and CellQuest software (Becton Dickinson). The data obtained at each experimental condition represent 10,000 events. Controls for blank and individual reagents, and self-competition are also performed for each experiment. Percent inhibition (minus non-specific competition), or the reduction in the percent-positive staining OVCAR-3 cells, is plotted as a function of competitor competition, and the  $IC_{50}$ , or the concentration of competitor at which 50% competition is observed, is determined.

[0324] An antibody is considered to compete if the  $IC_{50}$  for the competitor is at a concentration no more than about 100-fold above the labeled antibody. More preferably, an antibody is considered to compete if the  $IC_{50}$  for the competitor is at a concentration no more than about 10-fold above the labeled antibody. More preferably, an antibody is considered to compete if the  $IC_{50}$  for the competitor is at a concentration no more than about equimolar to the labeled antibody.

#### **8.0. HYBRIDOMA DEPOSITS**

[0325] Hybridoma 117.1, secreting monoclonal antibody 117.1 was deposited on August 2, 2002, with the American Type Culture Collection (ATCC<sup>®</sup>), 10801 University Boulevard, Manassass, Virginia 20110-2209, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-4567.

[0326] Hybridoma 368.1 secreting monoclonal antibody 368.1 was deposited on August 2, 2002, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-4568.

[0327] Hybridoma 501.1, secreting monoclonal antibody 501.1 was deposited on August 2, 2002, with the ATCC<sup>®</sup> under the provisions of the Budapest Treaty on the

International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-4569.

[0328] Hybridoma 776.1, secreting monoclonal antibody 776.1 was deposited on August 2, 2002, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-4570.

[0329] Hybridoma 15C9 secreting monoclonal antibody 15C9 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5106.

[0330] Hybridoma 16C7 secreting monoclonal antibody 16C7 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5107.

[0331] Hybridoma 16H9 secreting monoclonal antibody 16H9 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5108.

[0332] Hybridoma 4E7 secreting monoclonal antibody 4E7 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number 5109.

[0333] Hybridoma 7A11 secreting monoclonal antibody 7A11 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5110.

[0334] Hybridoma 7C6 secreting monoclonal antibody 7C6 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5111.

[0335] Hybridoma 7F10 secreting monoclonal antibody 7F10 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5112.

[0336] Hybridoma 7G10 secreting monoclonal antibody 7G10 was deposited on June 4, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number 5245.

[0337] Hybridoma 7H1 secreting monoclonal antibody 7H1 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5114.

[0338] Hybridoma 8A1 secreting monoclonal antibody 8A1 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5115.

[0339] Hybridoma 8B5 secreting monoclonal antibody 8B5 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5116.

[0340] Hybridoma 8C3 secreting monoclonal antibody 8C3 was deposited June 4, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number 5246.

[0341] Hybridoma 8E3 secreting monoclonal antibody 8E3 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5118.

[0342] Hybridoma 8G9 secreting monoclonal antibody 8G9 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5119.

[0343] Hybridoma 325.1 secreting monoclonal antibody 325.1 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5120. Hybridoma 325.1 secreting monoclonal antibody 325.1 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest

Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5120.

[0344] Hybridoma 621.1 secreting monoclonal antibody 621.1 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5121.

[0345] Hybridoma 633.1 secreting monoclonal antibody 633.1 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5122.

[0346] Hybridoma 654.1 secreting monoclonal antibody 654.1 was deposited June 4, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number 5247.

[0347] Hybridoma 725.1 secreting monoclonal antibody 725.1 was deposited on April 3, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5124.

[0348] Hybridoma 446.1 secreting monoclonal antibody 446.1 was deposited on September 25, 2003, with the ATCC<sup>®</sup>, under the provisions of the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedures, and assigned accession number PTA-5549.

[0349] The present invention is not to be limited in scope by the specific embodiments described herein. Indeed, various modifications of the invention in addition to those described herein will become apparent to those skilled in the art from the foregoing description and accompanying figures. Such modifications are intended to fall within the scope of the appended claims.

[0350] All publications, patents and patent applications mentioned in this specification are herein incorporated by reference into the specification to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated herein by reference. Citation or discussion of a reference herein shall not be construed as an admission that such is prior art to the present invention.